

# Service Guide

**HP 70909A/70910A**

**RF Section**



HP Part No. 70909-90035  
Printed in USA June 1998

Edition A.0.0

**Notice**

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

**Restricted Rights Legend.**

Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 for DOD agencies, and subparagraphs (c) (1) and (c) (2) of the Commercial Computer Software Restricted Rights clause at FAR 52.227-19 for other agencies.

©Copyright Hewlett-Packard Company 1998

All Rights Reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.  
1400 Fountaingrove Parkway, Santa Rosa, CA 95403-1799, USA

---

## Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

---

## Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

### LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

### EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

---

## Assistance

*Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.*

*For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.*

---

## Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

---

**CAUTION** The *CAUTION* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the product or the user's work. Do not proceed beyond a *CAUTION* sign until the indicated conditions are fully understood and met.

---

**WARNING** The *WARNING* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury to the user. Do not proceed beyond a *WARNING* sign until the indicated conditions are fully understood and met.

---

**DANGER** The *DANGER* sign denotes an imminent hazard to people. It warns the reader of a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *DANGER* sign until the indicated conditions are fully understood and met.

---

---

## General Safety Considerations

---

- WARNING**
- The instructions in this document are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.
  - The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.
  - The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.
  - This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.
  - For continued protection against fire hazard, replace fuse only with same type and ratings, (type nA/nV). The use of other fuses or materials is prohibited.
- 

- WARNING**
- Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.  
  
Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.
  - Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.  
  
Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.
-



# Contents

---

<b>1. Getting Started</b>	
Overview of Servicing . . . . .	1-2
Contacting Hewlett-Packard for Servicing or Ordering Parts . . . . .	1-6
<b>2. Installing and Configuring Module Verification Software</b>	
Computer Software Requirements . . . . .	2-2
Computer Hardware Requirements . . . . .	2-3
Installing Software and Creating Working Copies . . . . .	2-5
Configuring Module Verification Software . . . . .	2-11
Working with the TSCRIPT File . . . . .	2-16
Working with the MS_TABLE Data File . . . . .	2-23
<b>3. Running Module Verification Software</b>	
Loading from an SRM or HFS Hard Disk . . . . .	3-2
Entering Information About Your RF Section (UUT) . . . . .	3-3
Running from the Main Test Menu . . . . .	3-10
Working with the Calibration Editor . . . . .	3-12
<b>4. Test Equipment and Calibrations</b>	
Test Equipment Requirements . . . . .	4-2
Test Equipment Calibrations . . . . .	4-5
Spectrum Analyzer Calibration . . . . .	4-6
Flatness Calibration . . . . .	4-7
External Frequency Reference Requirements . . . . .	4-9
<b>5. Adjustment Procedures</b>	
Before You Begin Adjustments . . . . .	5-2
Overall Adjustment Setup . . . . .	5-4
Adjustment 01. Power Supply Voltage Checks . . . . .	5-5
Adjustment 02. 1st LO Power . . . . .	5-7
2nd Converter Adjustments . . . . .	5-10
Adjustment 03.01 VCO Tune-Line Voltage . . . . .	5-11
Adjustment 03.02 VCO Frequency and Amplitude . . . . .	5-13
Adjustment 03.03 2nd Converter LO Feedthrough . . . . .	5-15
Adjustment 03.04 Sampler DC IF Out . . . . .	5-17
Adjustment 03.05 Sampler AC IF Out . . . . .	5-19
Adjustment 03.06 Search Oscillator Duty Cycle and Period . . . . .	5-21
Adjustment 03.07 Search Oscillator Square Wave Min/Max . . . . .	5-23
Adjustment 03.08 Search Oscillator VCO Tune Line . . . . .	5-25
Adjustment 03.09 Phase Lock . . . . .	5-27
Adjustment 03.10 VCO Tune Range . . . . .	5-29
Adjustment 03.11 Lock Range Measurement . . . . .	5-32
Adjustment 03.12 Bandpass Filter and VCO Tune Range Final . . . . .	5-34
Adjustment 03.13 Mixer Bias . . . . .	5-37
Adjustment 04. Last Converter Alignment . . . . .	5-39
Adjustment 05. PGA Calibration . . . . .	5-44

Adjustment 06. YTF Alignment . . . . .	5-46
<b>6. Verification Tests</b>	
Before You Begin Testing . . . . .	6-2
Overall Test Setup . . . . .	6-4
Test 01. Switch Repeatability - HP 70910A Only . . . . .	6-5
Test 02. External Mixer Gain Calibration . . . . .	6-7
Test 03. Gain and Flatness Calibration . . . . .	6-9
Test 04. Flatness Below 50 MHz . . . . .	6-11
Test 05. Microwave Gain and Noise Figure . . . . .	6-13
Test 06. External Mixer Noise Figure . . . . .	6-17
Test 07. Microwave TOI . . . . .	6-19
Test 08. Diagnostics Check . . . . .	6-22
Test 09. Front Panel LEDs Check . . . . .	6-24
Test 10. 21.4 MHz IF Output Response . . . . .	6-25
Test 11. IF Emissions and Harmonics . . . . .	6-27
Test 12. EMIM LO Out Power and Harmonics . . . . .	6-29
Test 13. 1st LO Out Power and Harmonics . . . . .	6-31
Test 14. TUNE+SPAN+PRESEL PEAK Output . . . . .	6-33
Test 15. LO Input Amplitude Range . . . . .	6-35
Test 16. Microwave Image Rejection . . . . .	6-37
Test 17. EMIM Image Rejection . . . . .	6-39
Test 18. 2nd Converter Startup . . . . .	6-41
Test 19. Microwave Residual Responses . . . . .	6-43
Test 20. Microwave In-Range Multiples . . . . .	6-45
Test 21. 321.4 MHz IF Output Bandwidth - HP 70910A Only . . . . .	6-47
<b>7. Troubleshooting</b>	
Preparing a Static-Safe Work Station . . . . .	7-2
Power-On Failures . . . . .	7-4
Display Problems . . . . .	7-5
Mainframe Problems . . . . .	7-9
Communication Problems on the HP-MSIB I/O . . . . .	7-10
Error Messages . . . . .	7-13
Adjustment Problems . . . . .	7-17
Verification Test Problems . . . . .	7-23
Troubleshooting the A2 RF First Converter . . . . .	7-30
Troubleshooting the A5, A7, A8, A9 Second Converter . . . . .	7-31
Troubleshooting the A6 Programmable Gain Amplifier . . . . .	7-34
Troubleshooting the A10 Last Converter . . . . .	7-36
Troubleshooting the A11 5 dB Step Attenuator . . . . .	7-38
Troubleshooting the A12 RF Switch/A15 RF Switch and A21 Pin Switch/Diplexer . . . . .	7-39
Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver . . . . .	7-40
Troubleshooting the A16 Preamp/Mixer . . . . .	7-43
Troubleshooting the A18 LO Leveling Amplifier . . . . .	7-44
Troubleshooting the A20 Controller . . . . .	7-45
Performing Related Adjustments and Verification Tests . . . . .	7-47
Troubleshooting Utilities Menu . . . . .	7-50
Overall Block Diagram of HP 70909A or HP 70910A RF section . . . . .	7-53

**8. Replacing Major Assemblies**

Module Cover . . . . .	8-2
Front Panel . . . . .	8-4
Rear Panel . . . . .	8-6
A2 RF First Converter . . . . .	8-8
A5, A7, A8, A9 Second Converter . . . . .	8-10
A6 Programmable Gain Amplifier . . . . .	8-12
A10 Last Converter . . . . .	8-14
A11 5 dB Step Attenuator . . . . .	8-16
A12 RF Switch/A15 RF Switch (HP 70910A RF Section Only) . . . . .	8-18
A14 YTF . . . . .	8-20
A16 Preamp/Mixer . . . . .	8-22
A18 LO Leveling Amplifier . . . . .	8-24
A19 Power Supply/YTF Driver Service Position . . . . .	8-26
A19 Power Supply/YTF Driver . . . . .	8-28
A20 Controller . . . . .	8-30
A22 Status . . . . .	8-32

**9. Overall Parts Identification Drawings**

Major Cables and Assemblies . . . . .	9-2
Front View Identification . . . . .	9-8
Right Side View Identification . . . . .	9-9
Left Side View Identification, Exploded . . . . .	9-14
Rear View Identification . . . . .	9-16

**Index**

## Figures

---

1-1. Typical Serial Number Label . . . . .	1-6
3-1. Typical Serial Number Label . . . . .	3-3
4-1. Spectrum Analyzer Calibration Setup . . . . .	4-6
4-2. Flatness Calibration and Verification Test Setup . . . . .	4-7
4-3. Frequency Reference Connections, Using an HP 70310A Precision Frequency Reference . . . . .	4-10
4-4. Frequency Reference Connections, Using the HP 8566B Spectrum Analyzer . . .	4-11
5-1. Adjustments Equipment Matrix . . . . .	5-2
5-2. Overall Adjustment Equipment Setup . . . . .	5-4
5-3. Equipment Setup for Adjustment 01. Power Supply Voltage Checks . . . . .	5-5
5-4. Location of A19J8-1 . . . . .	5-6
5-5. Equipment Setup for Adjustment 02. 1st LO Power . . . . .	5-7
5-6. Side View Location of Adjustment 02. 1st LO Power . . . . .	5-7
5-7. PROTECT/ENABLE Switch Location . . . . .	5-9
5-8. 2nd Converter Adjustment Locations . . . . .	5-10
5-9. 2nd Converter Adjustment Locations . . . . .	5-10
5-10. Equipment Setup for Adjustment 03.01 VCO Tune-Line Voltage . . . . .	5-11
5-11. Locations for Adjustment 03.01 VCO Tune-Line Voltage . . . . .	5-11
5-12. Equipment Setup for Adjustment 03.02 VCO Frequency and Amplitude . . . . .	5-13
5-13. Locations for Adjustment 03.02 VCO Frequency and Amplitude . . . . .	5-13
5-14. Equipment Setup for Adjustment 03.03 2nd Converter LO Feedthrough . . . . .	5-15
5-15. Locations for Adjustment 03.03 2nd Converter LO Feedthrough . . . . .	5-15
5-16. Equipment Setup for Adjustment 03.04 Sampler DC IF Out . . . . .	5-17
5-17. Locations for Adjustment 03.04 Sampler DC IF Out . . . . .	5-17
5-18. Equipment Setup for Adjustment 03.05 Sampler AC IF Out . . . . .	5-19
5-19. Locations for Adjustment 03.05 Sampler AC IF Out . . . . .	5-19
5-20. Equipment Setup for Adjustment 03.06 Search Oscillator Duty Cycle and Period . . .	5-21
5-21. Locations for Adjustment 03.06 Search Oscillator Duty Cycle and Period . . . . .	5-21
5-22. Equipment Setup for Adjustment 03.07 Search Oscillator Square Wave Min/Max . . . . .	5-23
5-23. Locations for Adjustment 03.07 Search Oscillator Square Wave Min/Max . . . . .	5-23
5-24. Equipment Setup for Adjustment 03.08 Search Oscillator VCO Tune Line . . . . .	5-25
5-25. Locations for Adjustment 03.08 Search Oscillator VCO Tune Line . . . . .	5-25
5-26. Equipment Setup for Adjustment 03.09 Phase Lock . . . . .	5-27
5-27. Locations for Adjustment 03.09 Phase Lock . . . . .	5-27
5-28. Equipment Setup for Adjustment 03.10 VCO Tune Range . . . . .	5-29
5-29. Locations for Adjustment 03.10 VCO Tune Range . . . . .	5-29
5-30. Equipment Setup for Adjustment 03.11 Lock Range Measurement . . . . .	5-32
5-31. Locations for Adjustment 03.11 Lock Range Measurement . . . . .	5-32
5-32. Equipment Setup for Adjustment 03.12 Bandpass Filter and VCO Tune Range Final . . . . .	5-34
5-33. Locations for Bandpass Filter Tune Range and VCO Tune Range . . . . .	5-35
5-34. Equipment Setup for Adjustment 03.13 Mixer Bias . . . . .	5-37
5-35. Locations for Adjustment 03.13 Mixer Bias . . . . .	5-37
5-36. Equipment Setup for Adjustment 04. Last Converter Alignment . . . . .	5-39
5-37. Locations for Adjustment 04. Last Converter Alignment . . . . .	5-40
5-38. Equipment Setup for Adjustment 05. PGA Calibration . . . . .	5-44

5-39. Equipment Setup for Adjustment 06. YTF Alignment . . . . .	5-46
5-40. A19 OFFSET (R38) and GAIN (R39) Adjustments . . . . .	5-48
6-1. Verification Tests Equipment Matrix . . . . .	6-2
6-2. Overall RF Section Verification Test Setup . . . . .	6-4
6-3. Equipment Setup for Test 01. Switch Repeatability - HP 70910A Only . . . . .	6-5
6-4. Equipment Setup for Test 02. External Mixer Gain Calibration Test Setup . . . . .	6-7
6-5. Equipment Setup for Test 03. Gain and Flatness Calibration . . . . .	6-9
6-6. Equipment Setup for Test 04. Flatness Below 50 MHz . . . . .	6-11
6-7. Equipment Setup for Noise Figure Calibration . . . . .	6-13
6-8. Equipment Setup for Gain Calibration and Measurement . . . . .	6-14
6-9. Equipment Setup for Test 06. External Mixer Noise Figure . . . . .	6-17
6-10. Equipment Setup for Test 07. Microwave TOI . . . . .	6-19
6-11. Equipment Setup for Test 08. Diagnostics Check . . . . .	6-22
6-12. Equipment Setup for Test 09. Front Panel LEDs Check . . . . .	6-24
6-13. Equipment Setup for Test 10. 21.4 MHz IF Output Response . . . . .	6-25
6-14. Equipment Setup for Test 11. IF Emissions and Harmonics . . . . .	6-27
6-15. Equipment Setup for Test 12. EMIM LO Out Power and Harmonics . . . . .	6-29
6-16. Equipment Setup for Test 13. 1st LO Out Power and Harmonics . . . . .	6-31
6-17. Equipment Setup for Test 14. TUNE+SPAN+PRESEL PEAK Output . . . . .	6-33
6-18. Equipment Setup for Test 15. LO Input Amplitude Range . . . . .	6-35
6-19. Equipment Setup for Test 16. Microwave Image Rejection . . . . .	6-37
6-20. Equipment Setup for Test 17. EMIM Image Rejection . . . . .	6-39
6-21. Equipment Setup for Test 18. 2nd Converter Startup . . . . .	6-41
6-22. Equipment Setup for Test 19. Microwave Residual Responses . . . . .	6-43
6-23. Equipment Setup for Test 20. Microwave In-Range Multiples . . . . .	6-45
6-24. Equipment Setup for Test 21. 321.4 MHz IF Output Bandwidth . . . . .	6-47
7-1. Static-Safe Work Station . . . . .	7-2
7-2. Line Voltage Selector . . . . .	7-5
7-3. Line Fuse Removal and Replacement . . . . .	7-5
7-4. <code>display tests</code> Menu Keys . . . . .	7-7
7-5. Confidence Test . . . . .	7-8
7-6. Overall Block Diagram of HP 70909A or HP 70910A RF section . . . . .	7-53
8-1. Module Cover Removal/Replacement . . . . .	8-3
8-2. Front Panel Removal/Replacement . . . . .	8-5
8-3. Rear Panel Removal/Replacement . . . . .	8-7
8-4. A2 RF First Converter Removal/Replacement . . . . .	8-9
8-5. A5, A7, A8, A9 Second Converter Removal/Replacement . . . . .	8-11
8-6. A6 Programmable Gain Amplifier Removal/Replacement . . . . .	8-13
8-7. A10 Last Converter Removal/Replacement . . . . .	8-15
8-8. A11 5 dB Step Attenuator Removal/Replacement . . . . .	8-17
8-9. A12 RF Switch/A15 RF Switch Removal/Replacement . . . . .	8-19
8-10. A14 YTF Removal/Replacement . . . . .	8-21
8-11. A16 Preamp/Mixer Removal/Replacement . . . . .	8-23
8-12. A18 LO Leveling Amplifier Removal/Replacement . . . . .	8-25
8-13. A19 Power Supply/YTF Driver Service Position . . . . .	8-27
8-14. A19 Power Supply/YTF Driver Removal/Replacement . . . . .	8-29
8-15. A20 Controller Removal/Replacement . . . . .	8-31
8-16. A22 Status Removal/Replacement . . . . .	8-33
9-1. Overall Parts Identification Drawing, Major Cables (1 of 4) . . . . .	9-4
9-2. Overall Parts Identification Drawing, Major Cables (2 of 4) . . . . .	9-5
9-3. Overall Parts Identification Drawing, Major Cables (3 of 4) . . . . .	9-6
9-4. Overall Parts Identification Drawing, Major Cables (4 of 4) . . . . .	9-7
9-5. Overall Parts Identification Drawing, Front View . . . . .	9-8
9-6. Overall Parts Identification Drawing, Right Side View (1 of 4) . . . . .	9-10
9-7. Overall Parts Identification Drawing, Right Side View (2 of 4) . . . . .	9-11

9-8. Overall Parts Identification Drawing, Right Side View, Exploded (3 of 4) . . . .	9-12
9-9. Overall Parts Identification Drawing, Right Side View, Exploded (4 of 4) . . . .	9-13
9-10. Overall Parts Identification Drawing, Left Side View, Exploded . . . . .	9-15
9-11. Overall Parts Identification Drawing, Rear View . . . . .	9-16

## Tables

---

1-1. HP Service Centers . . . . .	1-7
1-2. Packaging for a 2/8 Module (RF Section) . . . . .	1-9
7-1. Static-Safe ESD Accessories . . . . .	7-3
7-2. Default HP-MSIB Address Map . . . . .	7-11
7-3. A11 5 dB Step Attenuator Logic . . . . .	7-38
9-1. Cables for the HP 70909A RF Section and HP 70910A RF Section . . . . .	9-2
9-2. Assemblies for the HP 70909A RF Section and HP 70910A RF Section . . . . .	9-3
9-3. Overall Parts Identification Listing, Front View . . . . .	9-8
9-4. Overall Parts Identification Listing, Right Side View . . . . .	9-9
9-5. Overall Parts Identification Listing, Left Side View Exploded . . . . .	9-14
9-6. Overall Parts Identification Listing, Rear View . . . . .	9-16



## Getting Started

---

### Overview    In this chapter you will learn about:

- Various types of test software available for your RF section
  - The organization of this service guide and component-level repair information
  - How to contact Hewlett-Packard for servicing or ordering parts
- 

This chapter introduces you to servicing and the various types of test software available for your RF section. You will first learn how the service guide and the component-level repair information (CLIP set) are organized, and then you'll learn how to contact Hewlett-Packard for servicing or ordering replacement parts.

#### *When is Servicing Needed?*

Servicing is needed:

- if error messages are displayed on your HP 70000 Series display
- if an ERROR LED or FAULT LED is on
- or, to perform repairs or adjustments or both

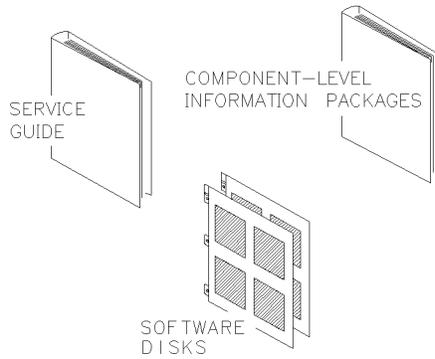
If you determine that your RF section needs servicing, you can return your RF section to a Hewlett-Packard service center, or you can perform the servicing yourself using module verification software and the information in this service guide.

To perform the servicing yourself using module verification software, review the rest of the information in this chapter, and then proceed to Chapter 2 where you will learn how to install and configure module verification software. To return your RF section to a Hewlett-Packard service center for service, refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts".

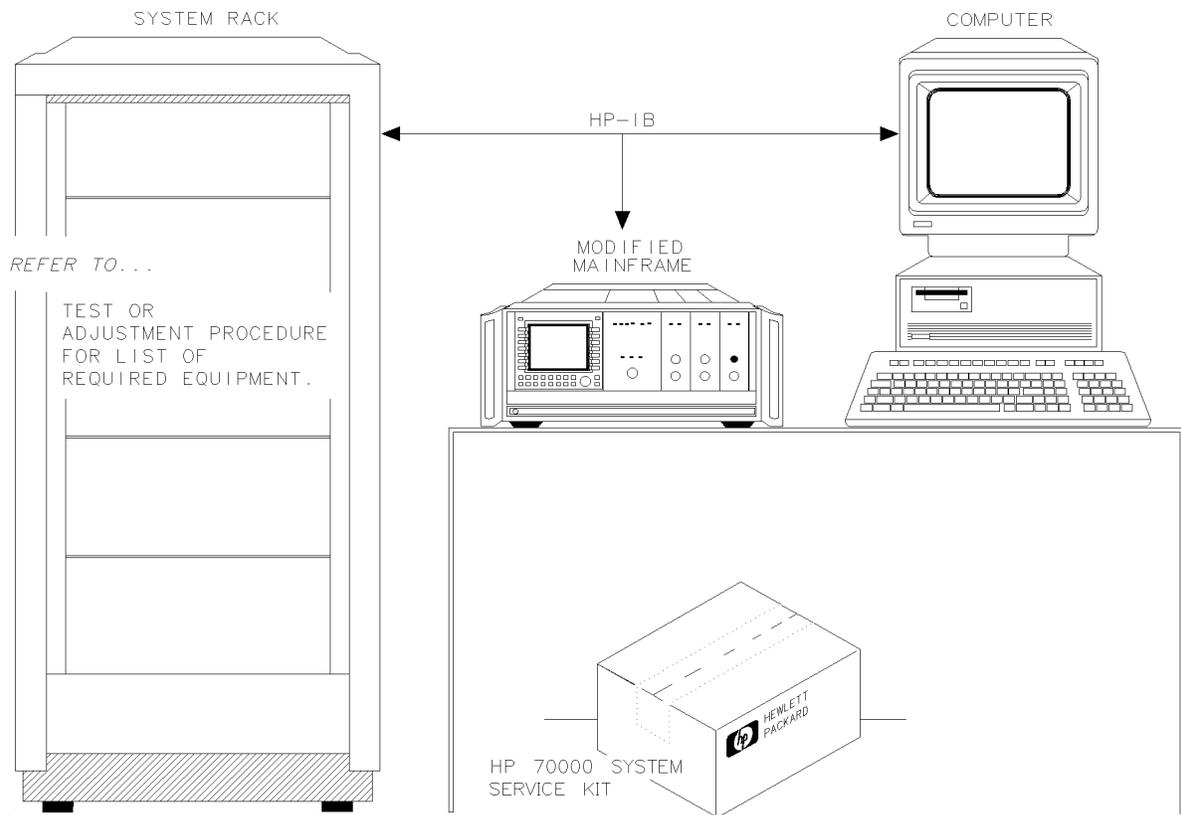
Overview of Servicing .....	1-2
Contacting Hewlett-Packard for Servicing or Ordering Parts .....	1-6

## Overview of Servicing

### DOCUMENTATION AND SOFTWARE SUPPLIED



### TOOLS AND EQUIPMENT NEEDED



sja54a

This service guide is part of an Option OB3 package which includes test software and two manuals.

<b>Test Software</b>	Module Verification Software
<b>Manual 1</b>	<i>HP 70909A/70910A Service Guide</i>
<b>Manual 2</b>	<i>HP 70909A/70910A Component Level Information Package</i>

## Types of Test Software Available

There are three categories of test software available, and this service guide documents the use of module verification tests.

**Module Verification Tests** Module verification tests are used to test modules so that when assembled into a system, the system meets the system's specifications. Module verification tests are used during servicing.

**System Verification Tests** System verification tests are used to verify the proper operation of an instrument and to verify that the instrument meets approximately 80% of its measurement related specifications. These sets of tests are subsets of system performance tests.

**System Performance Tests** System performance tests are used to verify the proper operation of a complete modular measurement system (MMS) to full system specifications.

For information related to system verification tests, refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual*, and for information related to system performance tests, refer to the documentation for HP 11990A system performance test software.

## Manual 1

This service guide describes all of the service procedures necessary to troubleshoot, repair, adjust, and test your RF section. The RF section is a module that is used in HP 70000 Series modular measurement systems. A standard modular spectrum analyzer system includes a mainframe with an RF section, IF section, local oscillator, an optional display, and an optional precision frequency reference.

### Chapter 1 "Getting Started"

This chapter introduces you to servicing and the various types of test software available for your RF section. You will first learn how the service guide and the component-level repair information (CLIP set) are organized, and then you'll learn how to contact Hewlett-Packard for servicing or ordering replacement parts.

### Chapter 2 "Installing and Configuring Module Verification Software"

This chapter prepares you to install and configure the module verification software for your RF section. You then learn how to load module verification software and how to change configuration settings by editing a TSCRIPT file. Finally, you'll learn how to use the MS\_TABLE program to specify different storage locations that CAL FACTOR data files and test results data can be stored and retrieved from.

### Chapter 3 "Running Module Verification Software"

This chapter prepares you to run the module verification tests on your RF section. You will learn how to load module verification software. Then, you will learn how to change parameters about your RF section that are used in creating reports. From there, you'll learn

## Overview of Servicing

how to run the module verification software tests, and finally, you'll learn how to create, edit, print, or purge a CAL FACTOR data file using the Calibration Editor program.

### Chapter 4 “Test Equipment and Calibrations”

This chapter contains the test equipment setups for all calibration procedures that must be performed in order to optimize module performance when assemblies are changed, repaired, or adjusted. You will learn about the requirements as well as when and how often calibrations are required. Finally, you'll learn about the requirements for the external frequency reference being used.

### Chapter 5 “Adjustment Procedures”

This chapter contains the test equipment setups for all adjustment procedures that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated and require a controller running module verification software.

### Chapter 6 “Verification Tests”

This chapter contains the test equipment setups for all module verification tests that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated and require a controller running module verification software.

### Chapter 7 “Troubleshooting”

This chapter prepares you for troubleshooting your RF section. You will learn how to prepare a static-safe work station that is used during servicing. Then, you will learn how to resolve power-on problems, adjustment problems, and verification test problems. Finally, you'll learn in-depth circuit troubleshooting as well as which adjustments and verification tests have to be run to ensure proper operation after an assembly has been repaired, replaced, or adjusted.

### Chapter 8 “Replacing Major Assemblies”

This chapter contains procedures for removal and replacement of major assemblies in your RF section.

### Chapter 9 “Overall Parts Identification Drawings”

This chapter contains information on all overall parts identification drawings that should be used when performing the troubleshooting procedures described in this service guide.

### Index

An index is also added at the end of this service guide to aid the user in finding key items of interest.

## Manual 2

Manual 2 is a separate volume that contains packets of component-level repair information for each RF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. Manual 2 also contains a table that can be used to cross reference different board assemblies that have different serial prefix breaks.

## Information Not Covered in Manual 1 or 2

- System configurations are documented in the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* and *HP 71910P Wide-Bandwidth Receiver User's Guide*.
- Error codes not covered in the troubleshooting chapter of this manual (Chapter 7) may be found in the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual*, *HP 71910P Wide-Bandwidth Receiver User's Guide*, and additional module specific service guides.
- Each modular measurement system (MMS) module has its own service guide. For further information related to the servicing of additional and alternate modules that can be used in this system, refer to each module's service guide.

## Before You Begin Servicing

Review the Troubleshooting sections of Chapter 7 as well as the directions for “Installing and Configuring Test and Adjustment Software” in Chapter 2.

## Contacting Hewlett-Packard for Servicing or Ordering Parts

Contact Hewlett-Packard for service or ordering parts.

**Service** Before calling Hewlett-Packard or returning your RF section for service, please read your warranty information. Warranty information is printed at the front of this service guide.

**Ordering Parts** To order parts, contact the HP Service Center closest to you.

In any correspondence or telephone conversations, refer to the RF section by its full model number and full serial number. With this information, the Hewlett-Packard representative can determine whether your unit is still within its warranty period.

### Determining Your RF Section's Serial Number

When a module is manufactured by Hewlett-Packard, it is given a unique serial number. This serial number is attached to a label on the front frame or front panel of the module. A serial number label is in two parts. (Refer to Figure 1-1.) The first part makes up the serial number prefix and consists of four digits and a letter. The second part makes up the serial number suffix and consists of the last five digits on the serial number label. The serial number prefix is the same for all identical modules; it only changes when a change in the electrical or physical functionality is made. The serial number suffix, however, changes sequentially and is different for each module.



**Figure 1-1. Typical Serial Number Label**

### Contacting Hewlett-Packard for Servicing or Ordering Parts

A current list of Hewlett-Packard Service Centers can be accessed on the Internet at:  
<http://www.tmo.hp.com/tmo/contacts/>

If you do not have access to the Internet, one of the following Hewlett-Packard locations can direct you to your nearest Hewlett-Packard representative:

**Table 1-1. HP Service Centers**

<b>United States</b>	Hewlett-Packard Company Test and Measurement Call Center (800) 403-0801 (800) 857-8161 (FAX)
<b>Canada</b>	Hewlett-Packard Canada Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 (905) 206-4725 (905) 206-4739 (FAX)
<b>Europe</b>	Hewlett-Packard European Marketing Centre Postbox 667 1180 AR Amstelveen Netherlands (31/20) 547-6669 (31/20) 647-8706
<b>Japan</b>	Hewlett-Packard Japan Ltd. 27-15, Yabe 1-Chome, Sagamihara, Kanagawa 229 Japan (81426) 567 832 (81426) 567 843 (FAX)
<b>Latin America</b>	Hewlett-Packard Latin America Region Headquarters 5200 Blue Lagoon Drive, 9th Floor Miami, Florida 33126 U.S.A. (305) 267 4245 (305) 267 4288 (FAX)
<b>Australia/New Zealand</b>	Hewlett-Packard Calibration Services Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 Australia 1800 802 540 1800 681 776 (FAX)
<b>Asia-Pacific</b>	Hewlett-Packard Asia-Pacific Ltd. 17-21/F Shell Tower, Times Square 1 Matheson Street, Causeway Bay Hong Kong (852) 25 997 777 (852) 25 069 261 (FAX)

## Contacting Hewlett-Packard for Servicing or Ordering Parts

### Returning Your RF Section for Service

Hewlett-Packard has sales and service offices around the world to provide complete support for your RF section. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard sales and service office listed in Table 1-1.

Use the following procedure to return your RF section to Hewlett-Packard for service:

1. Fill out a service tag (available at the end of this service guide) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
  - any error messages that appeared on the HP 70000 Series display
  - a completed Performance Test record
  - any other specific data on the performance of the RF section

---

**CAUTION** Damage can result if the original packaging materials are not used. Packaging materials should be anti-static and should cushion the RF section on all sides.

Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the instrument or prevent it from moving in the shipping container. Styrene pellets can also cause equipment damage by generating static electricity or by lodging in fan motors.

---

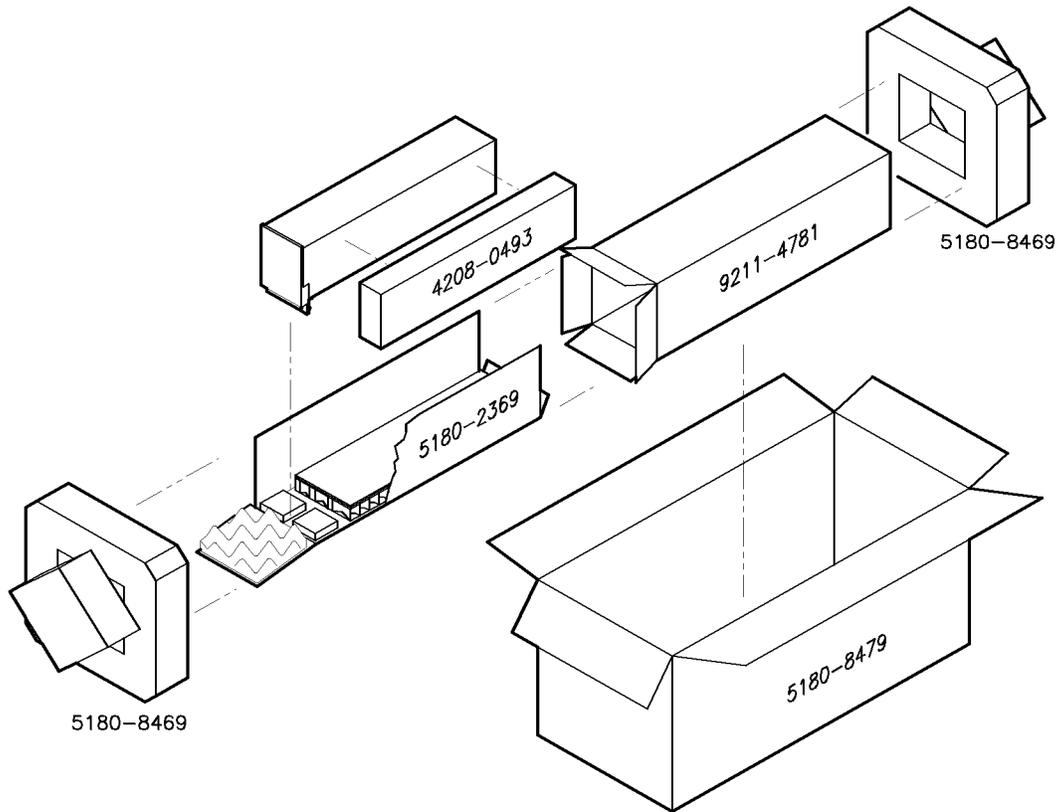
2. Place the RF section in its original packaging materials.

If the original packaging materials are not available, you can contact a Hewlett-Packard sales and service office to obtain information on packaging materials or you may use an alternative packing material referred to as "bubble-pack". One of the companies that makes bubble-pack is Sealed Air Corporation of Hayward, California, 94545.

3. Surround the RF section with at least 3 to 4 inches of its original packing material or bubble-pack to prevent the RF section from moving in its shipping container.
4. Place the RF section, after wrapping it with packing material, in its original shipping container or a strong shipping container that is made of double-walled corrugated cardboard with 159 kg (350 lb) bursting strength.

The shipping container must be both large enough and strong enough to accommodate your RF section and allow at least 3 to 4 inches on all sides for packing material.

5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to help ensure careful handling.
7. Retain copies of all shipping papers.



packing2

**Table 1-2. Packaging for a 2/8 Module (RF Section)**

Item	Description	HP Part Number	Qty
1	Carton-outer	5180-8479	1
2	Carton-inner	9211-4781	1
3	Carton-sliders	5180-2369	1
4	Foam inserts	4208-0493	1
5	Foam pads	5180-8469	2



## Installing and Configuring Module Verification Software

---

### Overview    In this chapter you will learn about:

- Computer software and hardware requirements
  - Keyboard compatibility
  - Installing module verification software, TSCRIPT, and MS\_TABLE
  - Purging module verification software, TSCRIPT, and MS\_TABLE
  - Test equipment requirements including default models and HP-IB addresses
  - Editing the TSCRIPT file
  - Specifying storage locations for CAL FACTOR data files and test result data
- 

This chapter prepares you to install and configure the module verification software for your RF section. You then learn how to load module verification software and how to change configuration settings by editing a TSCRIPT file. Finally, you'll learn how to use the MS\_TABLE program to specify different storage locations where CAL FACTOR data files and test results data can be stored and retrieved from.

Computer Software Requirements .....	2-2
Computer Hardware Requirements .....	2-3
Installing Software and Creating Working Copies .....	2-5
Configuring Module Verification Software .....	2-11
Working with the TSCRIPT File .....	2-16
Working with the MS_TABLE Data File .....	2-23

---

## Computer Software Requirements

To run the module verification software, your computer system must have the following components:

- HP BASIC 6.3 or above and the appropriate binary files loaded in the computer. If necessary, refer to an HP BASIC reference manual.

CLOCK	EDIT	KBD
CRTA	ERR	MAT
CRTB	GRAPH	MS
CRTX	GRAPHX	PDEV <sup>1</sup>
CS80	HFS <sup>2</sup>	SRM <sup>3</sup>
DCOMM <sup>3</sup>	HPIB	XREF <sup>1</sup>
DISC	IO	

<sup>1</sup> Optional: Required only for DEBUG.

<sup>2</sup> Optional: Required only for HFS (hierarchical file system) environment.

<sup>3</sup> Optional: Required only for SRM (shared resource management) environment.

---

## Computer Hardware Requirements

To run the module verification software, your computer system must have the following:

Computer	HP 9000 Series 300 controller
HP BASIC	HP BASIC 6.3 or above and the appropriate binary files loaded
RAM	8 MB of RAM
Interface	One HP-IB interface
Hard Disk	SRM or HFS hard disk with 5 MB available space
Floppy Disk	Dual or single 3.5 inch double-sided double-density 720 KB floppy disk drives

## Computer Keyboard Compatibility and Mouse Operation

The instructions in this service guide are based on an HP 9000 Series 300 controller with an HP 46021A keyboard. The module verification software supports several input devices; it will detect the keyboard you are using and will display the appropriate key commands. However, keystrokes and text differences may appear in the softkeys and menus displayed on screen. If you are using an HP 98203C keyboard, refer to the section “Using an HP 98203C Keyboard with a Series 300 Computer”.

### Using an HP 46021A Keyboard with a Series 300 Computer

If you use an HP 46021A keyboard (ITF keyboard) with a Series 300 computer, the module verification software assumes you have a mouse or a track ball.

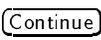
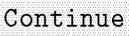
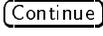
- To highlight your preference, press the **▲** or **▼** keys.
- To choose the highlighted item, press **Select**. To save your choice and return to the menu, press **Return**.
- To exit the menu, press **▶**.

## Computer Hardware Requirements

### Using an HP 98203C Keyboard with a Series 300 Computer

If you use an HP 98203C (Nimitz) keyboard, the equivalent keys are:

#### HP 46021A Keyboard    HP 98203C Keyboard

 (home)	 or 
	
	
	
	
 	

- To highlight an item in the menu, use  and , or turn the keyboard knob.
- To choose the highlighted item, press .
- To exit the menu, highlight  or , and press .

If neither  nor  is displayed, press  to exit.

### Using a Mouse with a Series 300 Computer

The module verification software displays the choices available in each menu screen.

- Slide the mouse up or down to highlight your preference.
- To choose the highlighted item, press the left-hand button on the mouse or slide the mouse to the right.
- To exit the menu, press  or  if they are displayed in a menu. If neither  nor  is displayed, slide the mouse to the left to exit.

---

## Installing Software and Creating Working Copies

---

### Overview In this section you will perform the following steps:

- Run INSTALL, from a floppy disk drive or other logical device, and create a working copy.

The INSTALL program performs the following:

- a. Assigns a source disk drive (and optional directory)
  - b. Assigns a destination disk drive (and optional directory)
  - c. Copies source files to the destination disk drive (and optional directory)
- 

Module verification software for the RF section consists of the following files:

Executive Disk 1	Executive Disk 2	Tests	Disk
OPV	UT_SUBS D_8757	DIAGNOSTIC	MW_IMGRJT
CSUBS	UT_SUBS0 D_3456	EM_IMGRJT	EMGAINCAL
CSUBS6	TSCRIPT D_3457	FLAT_50MH	AMP_ADJUST
CSUBS63_UX	TSCRIPT.MS D_436	LED_CHECK	LAST_CONV
CSUBS64_UX	TESTINFO D_438	MW_MULT	PGA_CALIB
CSUBS7_UX	OPTIONS D_8970	MWNOISEFIG	2ND_CONV
INSTALL	MUT_INFO D_8566	MW_RESID	PS_CHECK
COM	ADDR_DEFS D_71200	MW_TOI	SEC_STUP
UT_SUBS1	MUT_LIST D_3335	NIFO_RESP	YTF_ALIGN
CAL_EDIT	UNCERTS D_8662	TUNE_SPAN	WIDE_IFO
READ_ME	C_TSCRIPT D_8340	SW_REPEAT	WBFE_UTIL
DATA_SHEET	NET_ANAL D_836x	WIFO_300	TEST_SUBS
Disk_1	DVM Disk_2	EMNOISEFIG	REPT_SUBS
	ET	PWR_HARM	MS_TABLE
	PWR_MTR	PWR_HARM_	MS_TAB.MS
	RCVR	AMP_RANGE	EDIT_MSTAB
	SOURCE	FLATNESS	Disk_3
	SPEC_ANAL	SYS_CAL	

## Installing Software and Creating Working Copies

### To create a working copy on an SRM or HFS hard disk

In this section, you will learn how to create a working copy of module verification software on either an SRM (shared resource manager) or HFS (hierarchical file structure) hard disk drive.

The following steps assume that you have either an SRM or HFS hard disk system and a 3.5 inch double-sided floppy disk drive.

1. Insert *Executive Disk 1* of the module verification software into a 3.5 inch double-sided floppy disk drive.
2. Assign the MSI (mass storage is:) of the **source disk drive** and press .
- During a first-time installation, enter the MSI of the 3.5 inch double-sided floppy disk drive used in step 1.  
(For example, MSI " : ,700,0".)
- If you have a backup copy stored on a different disk drive that you would like to load instead, enter the full MSVS (mass storage volume specifier) of the disk along with any directory path.  
(For example, type MSI "/0PV9000/70909A\_10A: ,1400,0" or MSI "/0PV9000/70909A\_10A:HFS".)
3. Type LOAD "INSTALL",1 and press .

This runs the INSTALL program located on *Executive Disk 1*.

## Installing Software and Creating Working Copies

4. Read the installation overview screen that appears and press any key to continue.

```

INSTALLATION OVERVIEW
=====

HP 70909A/70910A Module Verification Software
must be installed on an SRH or HFS hard disk.

This installation creates a working copy. After
installation, store the original disks in a safe
place; they will only be needed in the event that
the working copy becomes corrupt or damaged. If
desired, backup copies can be created for archiving.

Press any key to continue...

```

5. At the program prompt, enter the MSVS of the **source** files and press **(Return)**.

- During a first-time installation, enter the MSVS of the 3.5 inch double-sided floppy disk drive used in step 1.

(For example, `:,700,0`. If you press **(Return)**, the default **source** MSVS is set using the value of the current MSI.)

- If you have a backup copy stored on a different disk drive that you would like to load instead, enter the full MSVS of the disk along with any directory path.

(For example, type `"/DPV9000/70909A_10A: ,1400 ,0"` or `"/DPV9000/70909A_10A:HFS"`.)

```

INSTALLING FILES ONTO AN SRH or HFS HARD DISK
=====

HFS systems require that you enter the volume specifier and a path.
(For example, /DPV9000/70909A_10A: ,1400,0 or /DPV9000/70909A_10A:HFS.)

SRH systems require that you enter the SRH select code and the node
address (for example, :,21,0 for an SRH system with a select code of 21
and a node address of 0). If a path is used, it must also be included.
(For example, /DPV9000/70909A_10A: ,21,0 or /DPV9000/70909A_10A:REHDTE.)

1. Press the Return key to accept the default MSVS specified,
   or Enter the MSVS of the source files and press Return:

   ..Default source MSVS: (A default source MSVS is displayed.)

```

## Installing Software and Creating Working Copies

6. At the program prompt, enter the MSVS, with an optional-directory path, of where the module verification software is to be installed and press **(Return)**; this sets the **destination** HFS/SRM directory path.
  - Press **(Return)** to accept /DPV9000/70909A\_10A/ as the default **destination** HFS/SRM directory path.
  - If you want the module verification software installed in a different directory, substitute a different **destination** HFS/SRM directory path and press **(Return)**.

```

INSTALLING FILES ONTO AN SRM or HFS HARD DISK
=====

HFS systems require that you enter the volume specifier and a path.
(For example, /DPV9000/70909A_10A:,1400,0 or /DPV9000/70909A_10A:HFS.)

SRM systems require that you enter the SRM select code and the node
address (for example, :,21,0 for an SRM system with a select code of 21
and a node address of 0). If a path is used, it must also be included.
(For example, /DPV9000/70909A_10A:,21,0 or /DPV9000/70909A_10A:REHOTE.)

1. Press the Return key to accept the default MSVS specified,
   or Enter the MSVS of the source files and press Return:

   Source MSVS: (A default source MSVS is displayed.)

2. Press the Return key to accept the default MSVS specified,
   or Enter the MSVS of the destination path and press Return:

   ...Default destination MSVS: (A default destination MSVS is displayed.)

```

### Tip

You can determine a complete directory path with the following steps:

- a. Press **(Stop)** to exit the module verification software.
- b. Assign the MSI (mass storage is:) of the SRM or HFS disk drive **without** including a directory path and press **(Return)**.  
(For example, type MSI " : ,1400,0" or MSI " :HFS".)
- c. Type CAT at the HP BASIC command prompt and look at the directory path that is displayed at the top of the listing.

If the top of the listing is not visible (due to a large number of files in the current directory that cause the display to scroll up out of view), you can either press the **(Prev)** button to view the top of the listing, or press **(Break)** before the top of the listing is scrolled out of view. In either case, you might wish to write down the directory path so that you can enter it at the prompt when needed.

- d. Repeat this procedure, "Loading software files onto an HFS hard disk", from the beginning.

**Installing Software and Creating Working Copies**

7. When prompted, remove *Executive Disk 1*, insert *Executive Disk 2*, and press **Continue**.

If you have an HP 46021A keyboard, and the **Continue** softkey does not appear on the display, press **(Menu)**. If you are using an HP 98203C keyboard, refer to the section “Using an HP 98203C Keyboard with a Series 300 Computer”.

8. When prompted, remove *Executive Disk 2*, insert the *Tests Disk*, and press **Continue**.

COPY COMPLETED is displayed when all files have successfully been copied.

## Installing Software and Creating Working Copies

### To purge a copy of module verification software

---

**CAUTION** If the directory being purged contains files that you wish to retain, move (relocate) the files to a different directory before performing this procedure.

---

**Note** In order to purge both files and a directory, your current MSI can not be set to the directory that you are purging.

---

#### If you are using HP BASIC 6.3 through HP BASIC 6.4:

1. Type, WILDCARDS UX; ESCAPE "\"
2. Type, PURGE "/OPV9000/[directory path]/\*"

You should get a prompt similar to the following (where xx is number of files):

A screenshot of a command prompt window with a black border. The text inside is centered and reads: "Purge xx files?" followed by a blank line and then "(Press &lt;Cont&gt; to proceed, &lt;Stop&gt;/&lt;Pause&gt; to cancel.)".

3. To purge the files, press **Continue**.  
This removes all of the files in the directory.
4. Type, PURGE "/OPV9000/[directory path]"  
This removes the directory itself.
5. Type, WILDCARDS OFF

---

## Configuring Module Verification Software

Before running module verification software, it should be configured to work with the test equipment and file system that you are using.

---

### Overview    **How to proceed:**

1. Configure the test equipment settings by editing the TSCRIPT file.  
When editing the TSCRIPT file, refer to the “Test Equipment Requirements”.
2. Run the EDIT\_MSTAB program and specify the storage locations of CAL FACTOR data files and test results. The EDIT\_MSTAB program modifies entries in the MS\_TABLE data file.
3. Load module verification software and enter information about your RF section (UUT).
4. Specify whether test reports are to be directed to the printer or the display.
5. Run module verification software from the main menu.

If you are required to use a power sensor in an adjustment or verification test, use the Calibration Editor program to create, edit, print, or purge CAL FACTOR data files, or change the directory path (MSVS) of where CAL FACTOR data files are located in your file system.

---

Connecting test equipment HP-IB interface cables .....	2-15
Working with the TSCRIPT File .....	2-16
Working with the MS_TABLE Data File .....	2-23

## Configuring Module Verification Software

### Test Equipment Requirements

The *HP 70909A/70910A module verification software* only contains drivers for the equipment shown in the table below. The equipment is listed in order of preferred model number.

In all cases, the specified aging rate requirement is  $10^{-9}$  ms/day. The microwave source, synthesized source, and calibrated spectrum analyzer listed in the following table have internal time bases that meet the aging rate requirement.

Equipment	TSCRIPT Label	Default HP-IB Address	Recommended Model
<b>Controller</b>		NONE	HP 9000 Series 300 controller (SELECT CODE 7 or 8.) <sup>1</sup>
<b>Signal Sources</b>			
Full microwave source	SYN1 <sup>2,3,4</sup>	727	HP 83630A/B Option 001 and 008 synthesized sweeper, or HP 83640A/B Option 001 and 008 synthesized sweeper, or HP 83650A/B Option 001 and 008 synthesized sweeper, or HP 8340B synthesized sweeper, or HP 8340A synthesized sweeper
Microwave source	SYN2 <sup>2,4</sup>	715	HP 83630A/B Option 001 and 008 synthesized sweeper, or HP 83640A/B Option 001 and 008 synthesized sweeper, or HP 83650A/B Option 001 and 008 synthesized sweeper, or HP 8340B synthesized sweeper, or HP 8340A synthesized sweeper
Synthesized source	SYN3	725	HP 8662A synthesized signal generator, or HP 8663A synthesized signal generator
Level generator	LG1	704	HP 3335A synthesizer/level generator
<b>Analyzers</b>			
Calibrated spectrum analyzer	SA1	728	HP 8566B spectrum analyzer (upgraded with firmware version 16.7.85 or later)
Scalar network analyzer	NA1 <sup>2,3,4</sup>	726	HP 8757D scalar network analyzer, or HP 8757C scalar network analyzer, or HP 8757B scalar network analyzer, or HP 8757A scalar network analyzer

<sup>1</sup> To determine the proper select code, refer to “Connecting test equipment HP-IB interface cables” in Chapter 2. If SELECT CODE 8 is used, all default addresses listed in the above table should be set with an Sxx HP-IB address, as opposed to 7xx. TSCRIPT addresses must also be updated to reflect these changes.

<sup>2</sup> The difference between the full microwave source and the microwave source is that *the full microwave source is the combination of a microwave source coupled with a scalar network analyzer.*

<sup>3</sup> To communicate with the full microwave source, when being used with a scalar network analyzer, HP-IB commands must be passed through the scalar network analyzer’s system interface bus (private bus) to the full microwave source. In order to accomplish this, the scalar network analyzer’s (internal) SWEEPER address and the HP-IB address of the full microwave source must be set to the same address. When using this version of module verification software, the scalar network analyzer’s (internal) SWEEPER address and the HP-IB address of the full microwave source must both be set to 19; this is hard-coded in the module verification software and can not be changed. (For further information, refer to the section “To specify SWEEPER and HP-IB addresses” in Chapter 2.)

<sup>4</sup> If using an HP 8360 Series synthesized sweeper for SYN1 or SYN2 (as designated in TSCRIPT), it must be placed in HP 8340 Compatibility Mode. (Refer to the procedure, “To set the HP 8360 Series Synthesized Sweeper to HP 8340 Compatibility Mode” in Chapter 2.)

## Configuring Module Verification Software

Equipment	TSCRIPT Label	Default HP-IB Address	Recommended Model
<b>HP 70000 Components</b>			
Local oscillator source	SYN4	718	HP 70900B local oscillator source (upgraded with firmware version 911021 [V.U.F. B.04.01] or later) or HP 70900A local oscillator source (upgraded with firmware version 911021 [V.U.F. B.04.01] or later)
Display			HP 70004A color display
Mainframe			HP 70001A mainframe
IF section			HP 70902A IF section
Module Extender			HP 70001-60013 extender module
Frequency reference			Refer to "External Frequency Reference Requirements" in Chapter 4.
<b>Meters</b>			
Noise source	NSRC	NONE	HP 346C broadband noise source
Noise figure meter	NMTR1	708	HP 8970B noise figure meter, or HP 8970A noise figure meter
Power meter	PM1 <sup>1,2</sup>	713	HP 436A power meter (2 required),
		713,0,0	or HP 438A dual-channel power meter
Power sensor	PM2 <sup>1,2</sup>	712	HP 436A power meter (2 required),
		713,0,1	or HP 438A dual-channel power meter
Power sensor	MWPS	NONE	HP 8485A APC-3.5 mm(m) power sensor
	LPPS	NONE	HP 8481D N(m) power sensor, or HP 8484A N(m) power sensor, or HP 8485D APC-3.5 mm(m) power sensor
	LFPS	NONE	HP 8482A N(m) power sensor, or HP 8481A N(m) power sensor
Precision DVM	DVM	722	HP 3456A digital multimeter, or HP 3457A digital multimeter

<sup>1</sup> When using an HP 436A power meter, the ADDRESS TYPE must be specified as HP-IB (as designated in TSCRIPT).

<sup>2</sup> When using an HP 438A dual-channel power meter, the ADDRESS TYPE must be specified as OTHER (as designated in TSCRIPT). The format that is used on the HP-IB address consists of three numbers separated by commas (713,0,0). The first number designates HP-IB address 713, followed by 0, followed by a 0 (selecting channel A) or a 1 (selecting channel B). For example, 713,0,0 designates channel A while 713,0,1 designates channel B.

## Configuring Module Verification Software

<p><b>Amplifiers</b>  HP 83006A microwave amplifier  HP 8447A RF amplifier,  or HP 8447D RF amplifier,  or HP 8447E RF amplifier,  or HP 8447F RF amplifier</p>
<p><b>Standard Equipment</b>  HP 8493C Option 006 coaxial fixed attenuator  HP 8493C Option 010 coaxial fixed attenuator  HP 11667B power splitter  HP 909D Option 011 50Ω 3.5 mm(f) termination  HP 11636B power divider/combiner  HP 85025B detector (2 required),  or HP 85025E detector (2 required)</p>
<p><b>Accessory Equipment</b>  HP 0955-0204 microwave isolator  HP 87421A power supply</p>
<p><b>Cables</b>  HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m) (6 required)  HP 8120-5022 365 mm SMB(f) to SMB(f) (5 required)  HP 5061-9038 520 mm SMA(m) to SMA(m)  HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m) (3 required)  HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f) (2 required)</p>
<p><b>Adapters</b>  HP 1251-2277 50Ω BNC(f) to dual banana plug  HP 1250-1236 50Ω SMB(f) to BNC(f)  HP 1250-0674 50Ω SMB(m) to SMA(f)  HP 1250-1158 50Ω SMA(f) to SMA(f) (2 required)  HP 1250-1292 50Ω BNC(f) to alligator clips  HP 1250-0672 50Ω SMB(f) to SMB(f)  HP 1250-1159 50Ω SMA(m) to SMA(m) (2 required)  HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f) (2 required)  HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m) (2 required)  HP 1250-1750 50Ω APC-3.5(m) to N(f)  HP 1250-1744 50Ω APC-3.5(f) to N(m) (2 required)</p>
<p><b>HP 70000 system service kit HP 71000-60002<sup>1</sup></b>  HP 70001-60013 extender module  HP 70001-00038 right modified mainframe cover  HP 70001-00039 left modified mainframe cover  HP 5021-6773 cable puller  HP 8710-1651 short 8 mm hex-ball driver<sup>2</sup>  HP 8710-1728 bandpass filter tuning tool<sup>2</sup>  HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f) (three)<sup>2</sup>  HP 5061-9021 390 mm SMB(f) to SMB(f) (seven)  HP 8160-0495 chromeric gasket (two feet)  HP 5021-7445 connector pin straightener</p>
<p><b>Accessory Service Tools</b>  HP 8710-0033 nonmetallic tuning tool  HP 8710-1791 ceramic adjustment tool  HP 08555-20097 5/16 inch modified box wrench</p>

<sup>1</sup> This kit includes servicing tools used to repair all HP 70000A modular spectrum analyzer modules, and a modification procedure for the HP 70001A mainframe which allows access to modules during bench testing and repair. This kit does not cover all MMS products.

<sup>2</sup> This part is required during servicing for the HP 70909A or HP 70910A RF section.

## Connecting Test Equipment HP-IB Interface Cables

1. Connect the HP-IB interface to the computer port.
  - If the computer has an HP 98624A HP-IB interface:
    - a. Connect the HP-IB interface to the port labeled HP-IB SELECT CODE 8.
    - b. Check that the address switch on the HP 98624A HP-IB interface matches the HP-IB controller device address.
    - c. If necessary, refer to *HP 9000 Series 200/300 Peripheral Installation Guide, Volume I*.
  - If the computer has an HP-IB interface other than an HP 98624A HP-IB interface:
    - a. Connect the HP-IB interface to the port labeled HP-IB SELECT CODE 7.
    - b. Check that the address switch on the HP-IB interface matches the HP-IB controller device address.
    - c. If necessary, refer to *HP 9000 Series 200/300 Peripheral Installation Guide, Volume I*.
2. Connect the HP-IB cables from the test equipment to the computer's HP-IB SELECT CODE 7 port.
3. If you are using an external disk drive, connect its HP-IB to the HP-IB SELECT CODE 7 port on the computer, using a 0.5 meter HP-IB cable (HP 10833D, or a similar cable).

Occasionally disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If this happens, connect the external disk drive to a separate HP-IB interface.
4. Set the external test equipment and the mainframe line switches to on. Allow the equipment to warm up as specified for the module verification software tests.
5. Turn on the computer (and the external disk drive).
6. If you are using an HP-IB printer, connect its HP-IB cable.

The HP-IB printer must be set to address 01 and can only be used with select code 7. This means that an HP-IB printer can only be used when it is set to HP-IB address 701; module verification software will not recognize an HP-IB printer at any other address.

---

## Working with the TSCRIPT File

---

**Overview** In this procedure, you will perform the following steps:

- a. Create a backup copy of the TSCRIPT file before making changes.
  - b. Load and edit the TSCRIPT file so that it matches your test equipment model numbers and HP-IB addresses.
  - c. Save the edited version of the TSCRIPT file.
  - d. Run the C\_TSCRIPT program which creates a new TESTINFO BDAT file.
- 

The TSCRIPT file contains the model numbers and HP-IB addresses of the test equipment and the test accessories required for each module verification software test.

Before module verification software runs any tests, equipment requirements are compiled into a list that is stored in the TESTINFO BDAT file. The TESTINFO BDAT file is created when the C\_TSCRIPT program is run. C\_TSCRIPT uses the TSCRIPT file as its information source. TSCRIPT is the file that you may need to edit to match both your equipment model numbers and HP-IB addresses. If your actual test equipment does not match both the model numbers and HP-IB addresses that are displayed and you continue, an error may occur.

If an error occurs, you can do one of the following:

- edit the TSCRIPT file to match both the HP-IB addresses and model numbers of your test equipment, and run the C\_TSCRIPT program to create a new TESTINFO BDAT file

This is the only way to match the TSCRIPT file to the model numbers of your test equipment.

- physically change the HP-IB addresses of your test equipment to match the displayed list
  - use EDIT mode to temporarily edit the HP-IB addresses of the test equipment being used
- 

**Note** If a cursor is not visible on your display, type the following command at the HP BASIC prompt and press (Return): control 1,10;1

---

## To create a backup copy of the TSCRIPT file

Using HP BASIC, create a copy of the TSCRIPT file.

For example:

1. Set the MSI to the MSVS of the disk drive that contains your working copy of module verification software.  
(For example, MSI "/OPV9000/70909A\_10A:,1400,0" or MSI "/OPV9000/70909A\_10A:HFS".)
2. Type, COPY "TSCRIPT" TO "TSCRIPT\_BK"

If ERROR 54 Duplicate file name is displayed, the TSCRIPT file has been previously backed up.

At this point, you can either:

- remove the previous backed-up file and then type COPY "TSCRIPT" TO "TSCRIPT\_BK"
- or, change the name of the backup file that is being created by typing COPY "TSCRIPT" TO "TSCRIPT\_BK2".

The time stamp on each file will show when each backup was created. To see the time stamps of all filenames that start with TS, type cat;select "TS".

## To load and edit the TSCRIPT file

3. Type GET "TSCRIPT" and press **(Return)**.  
Wait for the asterisk in the lower right-hand corner of the display to disappear.
4. Type EDIT and press **(Return)**.
  - a. Wait for the TSCRIPT file to appear on the display.
  - b. Refer to the following sections while editing the TSCRIPT file:
    - To edit test equipment and HP-IB address lists in the TSCRIPT file
    - To specify the default ADDRESS TYPE and ADDRESS for the UUT
    - To specify addresses for the full microwave source and scalar network analyzer
  - c. After editing the TSCRIPT file, save the edited version and run the C\_TSCRIPT program to create a new TESTINFO BDAT file; the newly created TESTINFO BDAT file is used when you run module verification software.

## Working with the TSCRIPT File

### To edit test equipment and HP-IB address lists in the TSCRIPT file

If your test equipment model numbers and HP-IB addresses are different from the default test equipment list that is displayed, you can edit the TSCRIPT file so that it matches your test equipment.

**Note** Edit only the following sections, and only in the method described. If the module verification software doesn't run as expected after editing the TSCRIPT file and running C\_TSCRIPT, you may have deleted or modified a character accidentally (for example, the right parenthesis that separates test descriptions).

If you can't identify the cause of the problem, make a new copy of TSCRIPT from the backup copy you created in previous steps and start again. (A backup copy of the original version of TSCRIPT shipped from Hewlett-Packard is in the file TSCRIPT.MS.)

#### 5. Using the key, scroll to CALIBRATION\_STANDARDS(.

This section of the TSCRIPT file defines the default list of test equipment that is used by module verification software. The list is organized as follows:

- a variable name, used by the TSCRIPT file, that identifies a particular type of test equipment (for example, PM1, PM2, MWPS); do not edit these variable names, they are used by module verification software.
- a list of test equipment model numbers separated by a single white space character; this list of model numbers is enclosed in parentheses. Only the first model number listed is used.

The `_1` and `_2` that are appended onto some of the test equipment model numbers are used to distinguish a specific piece of test equipment from another piece of test equipment of the same model. For example, PM1 and PM2 are different variable names used by the TSCRIPT file to identify two separate HP 438A dual-channel power meter ports. This is important because each port has a different power sensor that has its own correction data.

- a comment describing the function of the test equipment

```

CALIBRATION_STANDARDS(
  PH1(HP438A_1 HP436A_1)           * Power Meter #1
  PH2(HP438A_2 HP436A_2)           * Power Meter #2
  MWPS(HP8485A HP8481A)            * Sensor for PH1
  LPPS(HP8481D HP8484A HP8485D)    * Sensor for PH2
  *
  * When selecting a model for SYN1 or SYN2,
  * each HP836xx source must have Option 001 and 008 installed.
  *
  SYN1(HP83630B_1 HP83640B_1 HP83650B_1
        HP83630A_1 HP83640A_1 HP83650A_1
        HP8340B_1 HP8340A_1)        * Network Analyzer's Source
  NA1(HP8757D HP8757C HP8757A)     * Network Analyzer
  SYN2(HP83630B_2 HP83640B_2 HP83650B_2
        HP83630A_2 HP83640A_2 HP83650A_2
        HP8340B_2 HP8340A_2)        * Source
  SYN3(HP8662A HP8663A)             * Synthesized Source
  SYN4(HP70900B HP70900A)           * HHS L0 Source
  NHTR1(HP8970B HP8970A)            * Noise figure meter
  HSRC(HP346C)                      * Noise source
  SA1(HP8566B)                      * Spectrum Analyzer
  DVN(HP3456A HP3457A)              * Digital Voltmeter
  LG1(HP3335A)                      * Level Generator
)

```

---

**Note** If you are using an HP 8360 Series synthesized sweeper for SYN1 or SYN2, it must be set to HP 8340 Compatibility Mode.

Press the following keys on the HP 8360 Series synthesized sweeper:

- a. Press **LOCAL**.
- b. Press **MENU** from the **SYSTEM** group.
- c. Press **HP-IB MENU**.
- d. Press **Analyzr** from the **..Programming Language...** group so that an asterisk (\*) appears next to the word **Analyzr**.

The HP 8360 Series synthesized sweeper is in HP 8340 Compatibility Mode when the **\*Analyzr** key is shown and selected.

---

6. Edit the default list of test equipment according to the following process:

Module verification software uses the TSCRIPT file to identify which models of test equipment to use. The first model number following a variable name, in a parenthesized list, is the default model that is used; all additional models in the parenthesized list are ignored. The additional models are listed for reference only and may be deleted, moved, or duplicated.

To specify a particular model as the default instrument, place it first in the list after the opening parentheses. For example, to specify the HP 436A power meter as the default instrument to be used as PM1 instead of the HP 438A dual-channel power meter, scroll to the variable line that starts with PM1:

```
PM1(HP438A_1 HP436A_1)
```

You may make a change in either of three ways:

Move the selected model number to the position following the variable name, leaving the list of model numbers intact but changing their order.

The result is:

```
PM1(HP436A_1 HP438A_1)
```

**or**

Replace the model by typing the new model number over the old and press **Return** to save the change.

The result is:

```
PM1(HP436A_1 HP436A_1)
```

**or**

Move the selected model number to the position following the variable name, and delete the remaining models. If the selected model number has to be changed at a future date, refer to the **DEFAULT\_ADDRESSES**( section of the TSCRIPT file, and “Test Equipment Requirements”, at the beginning of this chapter.

The result is:

```
PM1(HP436A_1)
```

## Working with the TSCRIPT File

### 7. Using the **▲** key, scroll to the DEFAULT\_ADDRESSES(.

This section of the TSCRIPT file defines a list of default test equipment addresses; this list is used by module verification software.

Valid addresses are 02 to 20, and 22 to 30; address 21 is reserved for the controlling computer. Valid select codes are computer specific; normally, they are 7 or 8 (the default is 7); a label near the HP-IB port on your computer should identify the bus address. Do not set any of the equipment addresses to the address used by the unit under test (UUT) or the number 01; the HP-IB printer must be set to address 01 and can only be used with select code 7. This means that, an HP-IB printer can only be used when it is set to HP-IB address 701; module verification software will not recognize an HP-IB printer at any other address.

```
* NOTE: Do not change the ADDRESS TYPES (HP-IB, OTHER, or NONE)
*       You may only change the address information.
*       Only the address for each of the first listed model numbers in the
*       CALIBRATION STANDARDS section is used by C_TSCRIPT.
*
DEFAULT_ADDRESSES(
  "UUT"(OTHER 718,6,18)
  "HP438A_1"(OTHER 713,0,0)          * PH1   Power Sensor Channel 'A'
  "HP436A_1"(HP-IB 713)              * PH1
  "HP438A_2"(OTHER 713,0,1)         * PH2   Power Sensor Channel 'B'
  "HP436A_2"(HP-IB 712)              * PH2
  "HP8485A"(NONE)                   * HWPS  Do not edit
  "HP8481D"(NONE)                   * LPPS  Do not edit
  "HP8484A"(NONE)                   * LPPS  Do not edit
  "HP8485D"(NONE)                   * LPPS  Do not edit
  "HP8482A"(NONE)                   * LFPS  Do not edit
  "HP8481A"(NONE)                   * LFPS  Do not edit
  *-----
  * Check the documentation for addressing requirements before
  * editing the NA1 address or SYN1 passthrough address.
  * The SYN1 SWEEPER address for the HP 8757x system interface bus is
  * required to be 19 for this purpose.
  * This SWEEPER address is not reflected in this file.
  *
  "HP83630B_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP83640B_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP83650B_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP83630A_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP83640A_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP83650A_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP8340B_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP8340A_1"(HP-IB 727)            * SYN1  Passthrough address for HP 8757x
  "HP8757D"(HP-IB 726)              * NA1
  "HP8757C"(HP-IB 726)              * NA1
  "HP8757A"(HP-IB 726)              * NA1
  *-----
  "HP83630B_2"(HP-IB 715)            * SYN2
  "HP83640B_2"(HP-IB 715)            * SYN2
  "HP83650B_2"(HP-IB 715)            * SYN2
  "HP83630A_2"(HP-IB 715)            * SYN2
  "HP83640A_2"(HP-IB 715)            * SYN2
  "HP83650A_2"(HP-IB 715)            * SYN2
  "HP8340B_2"(HP-IB 715)            * SYN2
  "HP8340A_2"(HP-IB 715)            * SYN2
  "HP8662A"(HP-IB 725)              * SYN3
  "HP8663A"(HP-IB 725)              * SYN3
  "HP70900B"(HP-IB 718)             * SYN4  FW Revision 911021 or later
  "HP70900A"(HP-IB 718)             * SYN4  FW Revision 911021 or later
  "HP8970A"(HP-IB 708)              * HHTR1
  "HP8970B"(HP-IB 708)              * HHTR1
  "HP346C"(NONE)                    * NSRC
  "HP8566B"(HP-IB 728)              * SA1
  "HP3456A"(HP-IB 722)              * DVN
  "HP3457A"(HP-IB 722)              * DVN
  "HP3335A"(HP-IB 704)              * LG1
)
```

## To specify the default ADDRESS TYPE and ADDRESS for the UUT

If your RF section is set to an HP-IB and MSIB address other than the factory preset address of 718, 6, 18, you may modify the TSCRIPT file so that it uses the actual address of your RF section:

1. Scroll to the DEFAULT\_ADDRESSES( section of the file and edit the ADDRESS for the UUT.
2. Enter the HP-IB address (ADDRESS) followed by the MSIB row and column address; each entry must be separated by a comma.

For example, UUT"(OTHER 718,6,18) would set the UUT to HP-IB address 718, and the MSIB address to row 6 and column 18.

The alternative selections such as HP-IB and NONE are **not** used:

HP-IB	This selection is used by other portions of the module verification software. Do not specify the ADDRESS TYPE as HP-IB. It will cause an address conflict with the HP 70900A/B local oscillator source.
NONE	This selection is used by other portions of the module verification software. Do not specify the ADDRESS TYPE as NONE. It will disable HP-IB or MSIB communication with your RF section.

## To specify addresses for the full microwave source and scalar network analyzer

To communicate with the full microwave source, when being used with a scalar network analyzer, HP-IB commands must be passed through the scalar network analyzer's system interface bus (private bus) to the full microwave source.

In order to accomplish this, the scalar network analyzer's SWEEPER (internal) address and the HP-IB address of the full microwave source must be set to the same address. When using this version of module verification software, the scalar network analyzer's SWEEPER (internal) address and the HP-IB address of the full microwave source must both be set 19; this is hard-coded in module verification software and can not be changed.

Because the full microwave source receives its commands through the scalar network analyzer's system interface bus (private bus), the scalar network analyzer passes commands to the full microwave source at the scalar network analyzer's HP-IB address plus one (if the scalar network analyzer's HP-IB address is even) or at the scalar network analyzer's HP-IB address minus one (if the scalar network analyzer's HP-IB address is odd). So, when specifying an HP-IB in TSCRIPT for the full microwave source, it is either plus one above or minus one below the HP-IB address that is specified for the scalar network analyzer.

For example, if the scalar network analyzer is set to HP-IB address 726, the full microwave source must be specified as HP-IB address 727 in the TSCRIPT file. Both the scalar network analyzer's SWEEPER (internal) address and the HP-IB address of the full microwave source must be set to the same address; in this case, set them to 19.

Overview of steps performed in this example:

1. In the instrument only, set the scalar network analyzer's SWEEPER (internal) address to 19.
2. In both the TSCRIPT file and in the instrument, set the scalar network analyzer's HP-IB address to 726.
3. In the instrument only, set the full microwave source's HP-IB address to 19.
4. In the TSCRIPT only, set the full microwave source's HP-IB address to 727.

**Working with the TSCRIPT File****To save the edited TSCRIPT file**

1. Press **(Stop)** to exit editing mode.
2. Type RE-SAVE "TSCRIPT" .
3. Press **(Return)**.

Wait for the asterisk (\*) in the lower right-hand corner of the display to disappear.

4. Type LOAD "C\_TSCRIPT", 1 and press **(Return)**.

This creates a new TESTINFO BDAT file.

When Done. appears on the computer display, proceed to "Working with the MS\_TABLE Data File".

---

## Working with the MS\_TABLE Data File

A separate program referred to as the Mass Storage Table Editor (EDIT\_MSTAB) is used to specify the storage locations of CAL FACTOR data files and test results. The EDIT\_MSTAB program modifies entries in the MS\_TABLE data file.

### To change the storage locations of CAL FACTOR data files or test results

1. Select one of the following three choices:

- If this is the first time that you are running the EDIT\_MSTAB program:

Running with an initial copy of the MS\_TABLE data file:

- a. Type `LOAD "EDIT_MSTAB",1`.

The EDIT\_MSTAB program runs using initial default values.

Each time that the EDIT\_MSTAB program is run and changes are made to the settings in the MS\_TABLE data file, the MS\_TABLE data file is copied to the file MS\_TABLE\_; this file holds a single previous version of the MS\_TABLE data file. If there are no changes made to the settings in the MS\_TABLE data file, no MS\_TABLE\_ data file is created.

- If you decide that the MS\_TABLE data file no longer contains valid information, you can retrieve the previous version of the MS\_TABLE data file.

Retrieving and running with the previous MS\_TABLE data file:

- a. Type `PURGE "MS_TABLE"`.
- b. Type `COPY "MS_TABLE_" TO "MS_TABLE"`.
- c. Type `LOAD "EDIT_MSTAB",1`.

The EDIT\_MSTAB program runs using the values that were copied from the previous version of the MS\_TABLE data file (MS\_TABLE\_).

- If you decide that the MS\_TABLE data file or the MS\_TABLE\_ data file no longer contains valid information, you can reset the values to the original default values that were shipped with your module verification software by retrieving a master copy of the MS\_TABLE data file (MS\_TAB.MS).

Retrieving and running with a master copy of the MS\_TABLE data file:

- a. Type `PURGE "MS_TABLE"`.
- b. Type `COPY "MS_TAB.MS" TO "MS_TABLE"`.
- c. Type `LOAD "EDIT_MSTAB",1`.

The EDIT\_MSTAB program runs using the values that were copied from the master copy of the MS\_TABLE data file (MS\_TAB.MS).

## Working with the MS\_TABLE Data File

2. Read the present path and filename being displayed and verify that they are correct.

```

HSTABLE EDITOR v1.0
=====

The present path and filename for the location of the file HS_TABLE is:>

Do you want to change the path and/or filename for the location of HS_TABLE? (y/n)

```

- Enter n and press **(Return)** if the directory path and filename being displayed are correct.
  - Enter y and press **(Return)** if the MS\_TABLE data file is located in a different directory path or uses a different filename than the one that is displayed.
3. Read the MS\_TABLE settings that appear and decide whether or not you would like to change MS\_TABLE settings. Changing MS\_TABLE settings is completely optional; module verification software and STE9000 software can run with the default settings that are shown.

```

HSTABLE EDITOR v1.0
=====

CHANGE HS_TABLE SETTINGS
=====

1) Change where System Calibration Factors are stored.
   ...Current MSVS: /0PV9000/70909A_10A/CALFACTORS

2) Change where Test Results are stored.
   ...Current MSVS: /0PV9000/70909A_10A/RESULTS

q) Quit changing HS_TABLE settings and exit.

Select 1, 2, or q and press Return.

```

**System Calibration Factors**      The current MSVS specifies where the CAL FACTOR data files being used by the system are located.

This directory path (MSVS) can also be changed when using the Calibration Editor. (For further information, refer to “Working with the Calibration Editor” in Chapter 3.)

**Test Results**                      The current MSVS specifies where module verification software is to store and retrieve test results for printing.

4. To make a change, select 1 or 2 and press **(Return)**.
5. At the prompt, enter a new MSVS and press **(Return)**.  
The menu will redisplay with the new MSVS that you entered at the prompt.
6. When you are finished changing MS\_TABLE settings, select q and press **(Return)**.

## Running Module Verification Software

---

### Overview    In this chapter you will learn about:

- Loading module verification software from an SRM or HFS hard disk
  - Entering information about your RF section (UUT)
  - Directing test reports to the printer or the display
  - Running adjustments and verification tests
  - Working with the Calibration Editor and CAL FACTOR data files
- 

This chapter prepares you to run the module verification tests on your RF section. You will learn how to load module verification software. Then, you will learn how to change parameters about your RF section that are used in creating reports. From there, you'll learn how to run the module verification software tests, and finally, you'll learn how to create, edit, print, or purge a CAL FACTOR data file using the Calibration Editor program.

Loading from an SRM or HFS Hard Disk .....	3-2
Entering Information About Your RF Section (UUT) .....	3-3
Running from the Main Test Menu .....	3-10
Working with the Calibration Editor .....	3-12

---

## Loading from an SRM or HFS Hard Disk

1. Assign the MSI (mass storage is:) to the hard disk drive and directory path of where the module verification software is installed; this is the MSVS along with the optional-directory that was specified in the procedure, "To create a working copy on an SRM or HFS hard disk" in Chapter 2.

(For example, MSI "/0PV9000/70909A\_10A:,1400,0" or MSI "/0PV9000/70909A\_10A:HFS".)

2. Type LOAD "0PV",1 and press **(Return)**.
3. Highlight the model number being tested and press **(Return)**.

Make your selection from the menu by using the **(▲)** or **(▼)** keys to highlight the desired model number.



The acronym UUT [Unit Under Test] and DUT [Device Under Test] may be used throughout this book to refer to the RF section that is being tested.

4. Press **(▼)** to proceed to the next screen.

Continue with section titled, "Entering Information About Your RF Section (UUT)".

---

**Tips** To abort a test while running module verification software, press **(F8)**.

---

## Entering Information About Your RF Section (UUT)

If you are using *OPV* module verification software, use the instructions in this section to enter information that is required before accessing the Main Test Menu.

After you select either the HP 70909A RF section or the HP 70910A RF section, a display similar to the following appears:

```

===== UUT : HP 70909A =====
SERIAL NUMBER
ADDRESS TYPE    OTHER
ADDRESS        700
CONTROLLER
OPTIONS
TEMPERATURE    23.0 DEG C
HUMIDITY       50.0 %
LINE FREQUENCY 60 Hz

```

### To change the UUT's serial number

To ensure that test records are accurate, the complete serial number of the unit under test [UUT] should be entered.

1. Press **(Return)** to select **SERIAL NUMBER**.
2. Type the UUT's complete ten-digit serial number and press **(Return)**.

When equipment is manufactured by Hewlett-Packard, it is given a unique serial number. This serial number is attached to a label on the front frame or front panel of the module. A serial number label is in two parts. (Refer to Figure 3-1.) The first part makes up the serial number prefix and consists of four digits and a letter. The second part makes up the serial number suffix and consists of the last five digits on the serial number label. The serial number prefix is the same for all identical modules; it only changes when a change in the electrical or physical functionality is made. The serial number suffix, however, changes sequentially and is different for each module.



**Figure 3-1. Typical Serial Number Label**

## Entering Information About Your RF Section (UUT)

### To change the UUT's default HP-IB and MSIB address

```

===== UUT: HP 70909A =====
SERIAL NUMBER 0000A00000
ADDRESS TYPE  OTHER
ADDRESS       718,6,18
CONTROLLER
OPTIONS
TEMPERATURE   23.0 DEG C
HUMIDITY      50.0 %
LINE FREQUENCY 60 Hz
  
```

If your RF section is set to an HP-IB and HP-MSIB address other than the factory preset address of 718, 6, 18, you can modify the HP-IB and MSIB address for the UUT.

1. Use the  key to highlight ADDRESS TYPE and press .

A menu screen gives you the following choices:

```

HP-IB
NONE
OTHER
  
```

2. Use the  key to highlight OTHER and press .

A new menu appears which allows you to enter an HP-IB and MSIB address for the UUT.

3. Enter the HP-IB address followed by the MSIB row and column address of the UUT; each entry must be separated by a comma. For example, 718,6,18 would set the UUT to HP-IB address 718, and the MSIB address to row 6 and column 18.

The alternative selections are **not** used in this step:

**HP-IB** This menu selection is used by other portions of the module verification software.

Do not highlight HP-IB and press  when setting the UUT's default address. If you were to do this, a new menu would appear that allows you to select only the HP-IB address; doing this will cause an address conflict with the HP 70900A/B local oscillator source and it will not allow HP-IB or MSIB communication with your RF section.

**NONE** This menu selection is used by other portions of the module verification software.

Do not highlight NONE and press  when setting the UUT's default address. If you were to do this, NONE is selected as the ADDRESS; this selection will not allow HP-IB or MSIB communication with your RF section.

For further information, refer to the section, "To specify the default ADDRESS TYPE and ADDRESS for the UUT" under "Working with the TSCRIPT File" in Chapter 2.

## Entering Information About Your RF Section (UUT)

## To change the UUT's temperature setting

```

===== UUT: HP 70909A =====
SERIAL NUMBER 0000A00000
ADDRESS TYPE  OTHER
ADDRESS       718,6,18
CONTROLLER
OPTIONS
TEMPERATURE  23.0 DEG C
HUMIDITY     50.0 %
LINE FREQUENCY 60 Hz

```

You can enter the ambient temperature of the area in which the RF section is operating. This temperature data becomes part of the test record.

1. Use the **▼** key to highlight **TEMPERATURE**.
2. Press **(Return)** to move the cursor to the right-hand column.  
The default temperature is 23.0 degrees Celsius. Record the temperature only in degrees Celsius.
3. Use the **◀** or **▶** keys to move the cursor to the digit you want to change, then use the **▼** or **▲** keys to change the number. Press **(Return)** when finished entering the temperature.

## To change the UUT's humidity setting

```

===== UUT: HP 70909A =====
SERIAL NUMBER 0000A00000
ADDRESS TYPE  OTHER
ADDRESS       718,6,18
CONTROLLER
OPTIONS
TEMPERATURE  23.0 DEG C
HUMIDITY     50.0 %
LINE FREQUENCY 60 Hz

```

You can enter the humidity of the area in which the RF section is operating. This humidity data becomes part of the test record.

1. Use the **▼** key to highlight **HUMIDITY**.
2. Press **(Return)** to move the cursor to the right-hand column.  
The default humidity is 50 percent.
3. Use the **◀** or **▶** keys to move the cursor to the digit you want to change, and then use the **▼** or **▲** keys to change the number. Press **(Return)** when finished entering the humidity.

## Entering Information About Your RF Section (UUT)

### To change the UUT's line frequency

```

===== UUT: HP 70909A =====
SERIAL NUMBER 0000A00000
ADDRESS TYPE  OTHER
ADDRESS       718,6,18
CONTROLLER
OPTIONS
TEMPERATURE  23.0 DEG C
HUMIDITY     50.0 %
LINE FREQUENCY 60 Hz
  60 Hz
  50 Hz
  400 Hz

```

You can enter the power line frequency the RF section is using. This line frequency data is recorded with the test record.

1. Use the **▼** key to highlight **LINE FREQUENCY**.
2. Press **Return** to display the selection list.  
The default line frequency is 60 Hz.
3. Use the **▲** or **▼** keys to highlight the line frequency you are using; then press **Return** to select that frequency.
4. Review the other items in the list to determine if any other information needs to be changed.  
Use the **▲** or **▼** keys to highlight the item; then use the appropriate procedure in this section to enter the information.
5. When all information has been selected, press **▶** to continue.

### To specify whether test reports are printed or displayed

```

Where should test reports be directed?  CRT
                                         PRINTER
                                         NO OUTPUT

```

You can choose how you want to output test reports. Test reports may be printed on the computer's printer, displayed on the computer's CRT, or not displayed at all. By default, test reports are displayed on the computer's CRT.

1. Use **▼** and **▲** to direct test reports to the computer's display (CRT), to the printer, or to produce no output and press **Return**.

You may choose only one output option. If you select **PRINTER**, the HP-IB printer must be set to address 01 and can only be used with select code 7. This means that, an HP-IB printer can only be used when it is set to HP-IB address 701; module verification software will not recognize an HP-IB printer at any other address.

## Entering Information About Your RF Section (UUT)

**To resolve equipment models and HP-IB addresses**

When the module verification software begins, it started with a default list of test equipment and their associated HP-IB addresses. If the model numbers and addresses shown on your display match the model numbers and addresses of your test equipment, you can continue to the next section. If changes are needed, you can either change your test equipment to match the default list, or you can change the default list by changing the TSCRIPT file.

---

**Note** EDIT mode may also be used to change model numbers and HP-IB addresses while running module verification software, but the changes only remain in effect during the current session; the changes have to be repeated each time module verification software is run. (For further information, refer to the procedure, “To change addresses and test equipment using edit mode (EDIT)”, on the following page.)

---

```

EQUIPMENT USED (MODEL/ADDRESS) :
HP83640B_1      727
HP8757D         726
HP438A_1       713,0,0
HP8485A
HP8566B         728
HP70900B        718
HP3456A         722
HP8340B_2       715
HP8662A         725
HP3335A         704
HP438A_2       713,0,1
HP8481D
HP8970B         708      CONTINUE
HP346C          EDIT
HP8482A          PRINT

```

- If the model numbers and addresses shown on your display match the model numbers and addresses of your test equipment, highlight `CONTINUE` on the display, and then press `(Return)`.
- If the model numbers and addresses in this display *do not* match the model numbers and addresses of your test equipment, perform one of the following three procedures:

Conform to the displayed list by changing your test equipment and their associated addresses.

**or**

Select edit mode (EDIT) to change the test equipment addresses. (Because changes are not saved using this option, the changes must be repeated each time that the module verification software is run.) Model numbers cannot be changed here.

**or**

Edit the TSCRIPT file to change the test equipment and its addresses. (This requires exiting the module verification software and editing the TSCRIPT file. Refer to “Working with the TSCRIPT File” in Chapter 2.)

## Entering Information About Your RF Section (UUT)

### To print the default equipment list

If you have an HP-IB printer connected to your computer, you can print the default test equipment list when you are in the test equipment menu screen. The HP-IB printer must be set to address 01 and can only be used with select code 7. This means that, an HP-IB printer can only be used when it is set to HP-IB address 701; module verification software will not recognize an HP-IB printer at any other address.

1. Use **▼** to highlight **PRINT** on the display.
2. Press **Return**.

### To change addresses and test equipment using edit mode (EDIT)

```

=====EQUIPMENT USED FOR TESTS=====
HP83640B_1      0          727
HP8757D         0          726
HP438A_1       0          713,0,0
HP8485A
HP8566B        0          728
HP70900B       0          718
HP3456A        0          722
HP8340B_2      1          715
HP8662A        0          725
HP3335A        0          704
HP438A_2       0          713,0,1
HP8481D
HP8970B        0          708
HP346C
HP8482A

```

1. Highlight **EDIT** on the display and press **Select**. A new menu appears which lists the equipment, current default serial number, and the current address.
2. Use **▲** or **▼** to highlight the equipment you wish to change. A menu shows the selected equipment and associated information. Press **▼** to abort from a menu.

```

=====HP8340B=====
SERIAL NUMBER   1
ADDRESS TYPE    HP-IB
ADDRESS         727
OPTIONS
COMMENT

```

3. Use the appropriate procedure in this section to edit the address information.

---

**Note** Do not change the **ADDRESS TYPE**. Each model number of equipment has a defined **ADDRESS TYPE** and must not be changed. Each **ADDRESS TYPE** must be consistent with the corresponding models listed in the TSCRIPT file.

---

**Entering Information About Your RF Section (UUT)****To resolve address conflicts**

The program checks for equipment address conflicts and reports any conflicts that are found.

```
There is a device address conflict among the instruments that are
used for testing.  Two or more instruments are assigned at address
                                EDIT ADDR.
                                ABORT
--> 727 <--
```

1. To return to the equipment screen and edit the address, select EDIT ADDR.  
(For further information, refer to the procedure titled, “To change addresses and test equipment using edit mode (EDIT)” on the previous page.)
2. Select ABORT to go to the UUT entry window.  
(For further information, refer to “Entering Information About Your RF Section (UUT)”.)

## Running from the Main Test Menu

Module verification tests are used to test modules so that when assembled into a system, the system meets the system's specifications. All of the adjustments and verification tests are automated and computer controlled.

```

===== TEST LIST =====
Test Equipment Calibration Menu
Adj. 01. Power Supply Voltage Checks
Adj. 02. 1st LO Power
Adj. 03. 2nd Converter Adjustments Menu
Adj. 04. Last Converter Alignment
Adj. 05. PGA Calibration
Adj. 06. YTF Alignment
Test 01. Switch Repeatability
Test 02. External Mixer Gain Calibration
Test 03. Gain and Flatness Calibration
Test 04. Flatness Below 50 MHz
Test 05. Microwave Gain and Noise Figure
Test 06. External Mixer Noise Figure
Test 07. Microwave TDI
Test 08. Diagnostics Check
Test 09. Front Panel LEDs Check
Test 10. 21.4 MHz IF Output Response
Test 11. IF Emissions and Harmonics
Test 12. EHH LO Out Power and Harmonics
Test 13. 1st LO Out Power and Harmonics
Test 14. TUNE+SPAN+PRESEL PEAK Output
Test 15. LO Input Amplitude Range
Test 16. Microwave Image Rejection
Test 17. EHH Image Rejection
Test 18. 2nd Converter Startup
Test 19. Microwave Residual Responses
Test 20. Microwave In-Range Multiples
Test 21. 321.4 MHz IF Output Bandwidth
Utilities Menu

```

**Making Selections** Use the  and  keys to highlight a selection and press .

You do not have to perform all the adjustments and tests in one session; you may quit at any time. However, module verification software *does not* save a record of completed adjustments or tests.

**Adjustment Order** Module verification software adjustments must be run consecutively.

**Testing Order** Module verification software tests can be run in any order with the exception of Test 03. Gain and Flatness Calibration and Test 04. Flatness Below 50 MHz, which must be run in consecutive order; do not run them out of order.

**Testing Required** Not all adjustments and verification tests must be run while troubleshooting. For a listing of adjustments and verification tests that must be performed to ensure proper operation after an assembly has been repaired, replaced, or adjusted, refer to "Performing Related Adjustments and Verification Tests" in Chapter 7.

**Testing Results** If you would like a record of the verification tests you have completed, direct the test results to your printer. For further information, refer to the section earlier in this chapter, "To specify whether test reports are printed or displayed".

If you would like a record of the adjustments and verification tests that have PASSED or FAILED, perform a **dump graphics** with the test list displayed.

**To abort from the main test menu**

1. Press  to abort from the main test menu.

A dialog box asks if you wish to return to the MMS module selection menu.

Return to main MMS module selection menu? YES
NO

- Select YES to return to the main MMS module selection menu.
- Select NO to view the test list.

---

## Working with the Calibration Editor

Both the *OPV* and the *CTM* module verification software use the Calibration Editor described in this section.

The Calibration Editor provides the ability to create, select, edit, print, or purge a CAL FACTOR data file, or change the directory path (MSVS) of where CAL FACTOR data files are located in your file system.

If a power sensor is used during an equipment calibration, adjustment, or verification test, a CAL FACTOR data file is required. A CAL FACTOR data file contains correction factors that are used to adjust the measured power level at a set of frequencies. This effectively corrects the amplitude response of the power sensor so that its power measurements are accurate over its frequency range. Correction factors are typically listed on the power sensor being used.

---

### Notes

- To abort from any of the entry menus in this program and return to the main test menu, press **F8**.
- The Calibration Editor is **not** used to enter the correction data for the HP 346C broadband noise source. Correction data for the HP 346C broadband noise source is entered while running Test 05, Microwave Gain and Noise Figure.

The CAL FACTOR data file for the HP 346C broadband noise source is stored in the same location as power sensor CAL FACTOR data files.

*Naming conventions for noise source CAL FACTOR data files:*

Each noise source CAL FACTOR data file has a unique file name, made up of three parts.

*Part 1*            Each noise source CAL FACTOR data file name begins with the four letters CFNS.

*Part 2*            Following the letters CFNS are the last five digits of the noise source serial number; they are used to uniquely specify a CAL FACTOR data file name. This is important if you are using two or more noise sources with the same model and version because each noise source must have its own CAL FACTOR data file.

*Part 3*            The last character in the CAL FACTOR data file name is made from the noise source model C.

---

## Starting the Calibration Editor

There are two ways to start the Calibration Editor:

- Manually** The Calibration Editor can be started manually through the Utilities Menu.
- Automatically** If module verification software tries to access a CAL FACTOR data file for a power sensor and one can not be found or a power sensor has passed its calibration due date, a warning screen similar to the following is displayed.

```

WARNING
=====
The CAL FACTOR data file CF8xxxxxxx that is required
for calibration of the HP 43xA power meter could not
be found. Do you wish to start the Calibration Editor
or re-edit the POWER SENSOR INFORMATION menu?
EDIT SENSOR INFO
CAL EDITOR
ABORT

```

- EDIT SENSOR INFO** Use this selection to return to the Power Sensor Identification menu and enter a different power sensor serial number; doing this will effectively specify a new CAL FACTOR data file to be searched for and if found, loaded automatically. The warning message will repeat if a CAL FACTOR data file still can not be found for the new power sensor serial number that you specify.
- If the warning message repeats, you are either specifying incorrect information on the Power Sensor Identification menu, the CAL FACTOR data file does not exist in the currently specified directory path (MSVS), or you are specifying an incorrect directory path (MSVS); the MS\_TABLE data file specified the current directory path (MSVS). You can select CAL EDITOR to access the Calibration Editor program and either create a new CAL FACTOR data file or change the directory path (MSVS) of where CAL FACTOR data files are located.
- CAL EDITOR** Use this selection to start the Calibration Editor program. Starting the program this way gives you access to all of the Calibration Editor functions that you would have when the program is started manually plus the menu selection, SELECT CAL FACTOR FILE. (For further information, refer to the procedure “Selecting a CAL FACTOR data file” later in this chapter.)
- ABORT** Use this selection to abort and return to the main test menu.

## Working with the Calibration Editor

1. If the Calibration Editor starts automatically, because the required CAL FACTOR data file cannot be found, the following screen is displayed.

```

The Calibration Editor can be used to find the
CAL FACTOR data file that was expected or a new
CAL FACTOR data file can be created.

...CAL FACTOR data file that is expected:  CF8xxxxxxx

The following data is required if you decide to create
a new CAL FACTOR data file.

...Model number of power sensor being calibrated:  HP8xxxxx
...Serial number of power sensor being calibrated:  yyyAzzzzz

```

2. Once you have passed the introductory screen (when starting manually or if you select CAL EDITOR from the previous warning screen that is displayed when started automatically), the following screen is displayed which allows you to change or verify the computer's internal clock settings.
3. The following screen allows you to change or verify the computer's internal clock settings. The screen is displayed whether you start the Calibration Editor manually or automatically.

```

When creating new files or editing existing files,
the date read from your computer's internal clock
is used to time-stamp CAL FACTOR data files.

Current internal clock date: 13 Dec 199x

If this date is NOT correct, select RESET DATE to CONTINUE
change it.                                     RESET DATE

```

- Select CONTINUE to accept the computer's internal clock date if it is correct.
  - Select RESET DATE to edit the computer's internal clock date.
    - To select the various fields, use the **←** or **→** arrow keys to move the cursor.
    - To change a value, use the **↑** or **↓** arrow keys.
- Press **Return** when you are finished editing the computer's internal clock.

4. After verifying or updating the computer's internal clock, the following screen is displayed.

```
=====Enter the CAL FACTOR volume MSVS=====
/0PV9000/70909A_10A/CALFACTORS
```

- Press **(Return)** if the directory path (MSVS) being displayed is the correct location of the power sensor CAL FACTOR data files in your file system. This directory path (MSVS) is saved in the MS\_TABLE data file.
- If CAL FACTOR data files are located in a different directory path (MSVS) than the one that is displayed, enter the directory path (MSVS) that you wish the Calibration Editor to search and press **(Return)**.

For example, /0PV9000/70909A\_10A/CALFACTORS is the default directory path (MSVS) that was specified in the MS\_TABLE data file. Changing the directory path (MSVS) using this menu selection changes the location of where CAL FACTOR data files are searched for in your file system.

Changing the directory path (MSVS) in this procedure also changes the directory path (MSVS) used by the MS\_TABLE data file. (For further information, refer to “Working with the MS\_TABLE Data File” in Chapter 2.)

**Working with the Calibration Editor**

5. After verifying or updating the CAL FACTOR volume (MSVS), the following screen is displayed.

```

=POWER SENSOR CAL FACTOR MANAGEMENT=
NEW CAL FACTOR FILE
SELECT CAL FACTOR FILE
EDIT CAL FACTOR FILE
PRINT CAL FACTOR FILE
PURGE CAL FACTOR FILE
CHANGE CAL FACTOR VOL
EXIT

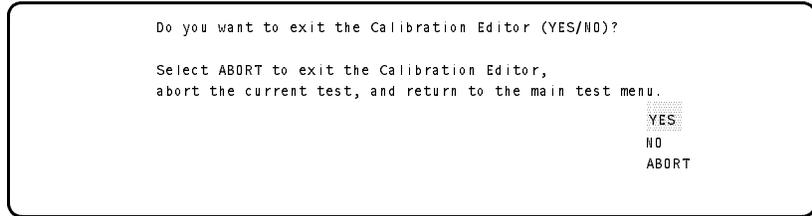
```

NEW CAL FACTOR FILE	Use this selection to create a new CAL FACTOR data file. (Refer to “Creating a new CAL FACTOR data file”.)
SELECT CAL FACTOR FILE	Use this selection to select an existing CAL FACTOR data file. This menu selection is only available when the Calibration Editor program is started automatically. (Refer to “Selecting a CAL FACTOR data file”.)
EDIT CAL FACTOR FILE	Use this selection to edit the entries in an existing CAL FACTOR data file. (Refer to “Editing a CAL FACTOR data file”.)
PRINT CAL FACTOR FILE	Use this selection to print the entries in an existing CAL FACTOR data file. (Refer to “Printing a CAL FACTOR data file”.)
PURGE CAL FACTOR FILE	Use this selection to purge an existing CAL FACTOR data file from the file system. (Refer to “Purging a CAL FACTOR data file”.)
CHANGE CAL FACTOR VOL	Use this selection to specify the directory path (MSVS) of where in the file system that a CAL FACTOR data file is located. (Refer to “Changing the CAL FACTOR data file volume (MSVS)”.)  The default directory path (MSVS) was specified in the MS_TABLE data file. (For further information, refer to “Working with the MS_TABLE Data File” in Chapter 2.)

## Working with the Calibration Editor

### EXIT

Use this selection to exit the Calibration Editor. Before exiting, the following screen is displayed:



- |       |  |
|-------|--|
| YES   | Use this selection to exit the Calibration Editor and continue the test.                                     |
| NO    | Use this selection to continue using the Calibration Editor and redisplay its menu.                          |
| ABORT | Use this selection to exit the Calibration Editor, abort the current test, and return to the main test menu. |

## Working with the Calibration Editor

### Creating a new CAL FACTOR data file

If a CAL FACTOR data file does not exist for the power sensor that is being used, one must be created.

During this procedure, you will select a power sensor model from a list, then you will enter its serial number and calibration due date. This information is necessary before proceeding to the POWER SENSOR EDITING menu.

- Using the **▲** and **▼** arrow keys, select **NEW CAL FACTOR FILE** from the POWER SENSOR CAL FACTOR MANAGEMENT menu and press **(Return)**.

```

=====POWER SENSOR INFORMATION=====
POWER SENSOR MODEL      HP8481D
POWER SENSOR SERIAL     0246A02928
POWER SENSOR CAL DUE    13 June 199x
  
```

#### POWER SENSOR MODEL

Use this selection to change the model number of the power sensor being used.

```

HP8481A
HP8481D
HP8482A
HP8484A
HP8485A
HP8485D
  
```

A screen displays a list of HP power sensors to choose from. This list contains all of the power sensor models that are supported by *HP 70909A/70910A module verification software* along with additional models that are not currently supported. Although you can use the Calibration Editor program to create, select, edit, print, or purge CAL FACTOR data files for all of the power sensors that are listed, only the power sensors listed under “Test Equipment Requirements” can be used with module verification software. (Refer to Chapter 2 or “Test Equipment Requirements” in Chapter 4 for a list of power sensors that can be used with module verification software.)

Use **▲** or **▼** arrow keys to select the model number of the power sensor being used in your test system and press **(Return)**.

If a CAL FACTOR data file already exists for a particular power sensor, a dialog box asks if you wish to replace the existing CAL FACTOR data file. If you answer YES, the CAL FACTOR data file will be overwritten with the data you enter from the POWER SENSOR EDITING menu. (Refer to “Editing a CAL FACTOR data file”.)

**Working with the Calibration Editor***Naming conventions for CAL FACTOR data files:*

Each CAL FACTOR data file has a unique file name, made up of three parts, that are derived from the values supplied to the POWER SENSOR INFORMATION menu.

- Part 1* Each CAL FACTOR data file name begins with the two letters CF.
- Part 2* The last two digits in the power sensor model together with the version (A, B, C, or D) of the power sensor model create the next three characters in the CAL FACTOR data file name.
- Part 3* The last five digits of the power sensor serial number are used to uniquely specify a CAL FACTOR data file name; this is important if you are using two or more power sensors with the same model and version because each power sensor must have its own CAL FACTOR data file.

**POWER SENSOR SERIAL**

Use this selection to enter or change the serial number of the power sensor being used.

When power sensors are manufactured by Hewlett-Packard, they are given a unique serial number. This serial number is typically attached to a label located on the power sensor being used. A serial number label is in two parts. The first part makes up the serial number prefix and consists of four digits and a letter. The second part makes up the serial number suffix and consists of the last five digits on the serial number label. The serial number prefix is the same for all identical power sensor models; it only changes when a change in the electrical or physical functionality is made. The serial number suffix, however, changes sequentially and is different for each power sensor.

**POWER SENSOR CAL DUE**

Use this selection to enter or change the calibration due date of the power sensor being used.

## Working with the Calibration Editor

If you enter the current date or a date earlier than the current date as the POWER SENSOR CAL DUE entry, module verification software will view the power sensor as overdue for calibration. This will start the Calibration Editor program and display a warning screen similar to the following:

```
The Calibration Editor has been started because the power sensor designated
on the Power Sensor Identification menu has past its calibration due date.

...CAL FACTOR data file that is out of date:  CF8xxxxxxx

* If the currently selected power sensor has been recalibrated and new
calibration data is available, you can edit the CAL FACTOR data file
listed above using the EDIT CAL FACTOR FILE selection.

* If there is no new calibration data for the current power sensor, select a
different power sensor and its corresponding CAL FACTOR data file by
aborting the tests and returning to the main MMS module selection menu.

* If you decide to edit other CAL FACTOR data files, other than the one listed
above, assure that the last CAL FACTOR data file loaded is the one that is
to be used during testing. Failure to do this will produce an error.
```

To resolve this problem:

- a. If the currently selected power sensor has been recalibrated and new calibration data is available, use the Calibration Editor to edit the calibration data in the CAL FACTOR data file listed above:
  - i. Use EDIT CAL FACTOR FILE available from the POWER SENSOR CAL FACTOR MANAGEMENT menu.
  - ii. Use EDIT CAL FACTORS available from the POWER SENSOR EDITING menu.
- b. If there is no new calibration data for the current power sensor, select a different power sensor and its corresponding CAL FACTOR data file.

If you decide to use a different power sensor:

- i. Abort the Calibration Editor.
- ii. Abort the tests menu.
- iii. Return to the main MMS module selection menu.
- iv. Enter information for a new power sensor.

You can not simply change the POWER SENSOR MODEL or the POWER SENSOR SERIAL on the POWER SENSOR INFORMATION menu, you must return to the main MMS module selection menu and enter the information for the new power sensor.

---

### Note

If you decide to use other functions of the Calibration Editor or edit other CAL FACTOR data files, other than the one listed above, you must make sure that the last CAL FACTOR data file that is loaded is the one that is to be used during testing or an error message will be displayed; this only occurs when the Calibration Editor is entered automatically.

---

**Working with the Calibration Editor**

If you fail to load the CAL FACTOR data file that is required for the power sensor that was designated on the Power Sensor Identification menu, a warning screen similar to the following is displayed:

```
The Calibration Editor has been re-started because the
CAL FACTOR data file required for the power sensor designated
on the Power Sensor Identification menu does not match.

...CAL FACTOR data file that was expected:  CF8xxxxxx
...CAL FACTOR data file that was loaded:    CF8yyyyyy

* In order to continue testing, use SELECT CAL FACTOR FILE
  from the Calibration Editor main menu to load the
  CAL FACTOR data file that is expected.

* If you decide to use a different power sensor, you must
  abort the tests, return to the main HHS module selection
  menu, and enter the information for the new power sensor.

* The following data is required to create a new CAL FACTOR data file.

...Model number of power sensor being calibrated:  HP8xxxxx
...Serial number of power sensor being calibrated:  yyyAzzzz
```

To resolve this problem:

- From the Calibration Editor main menu, use **SELECT CAL FACTOR FILE** to load the expected CAL FACTOR data file.

If you decide to use a different power sensor:

- a. Abort the Calibration Editor.
  - b. Abort the tests menu.
  - c. Return to the main MMS module selection menu.
  - d. Enter information for a new power sensor.
2. When finished entering information for a particular power sensor model, press  and proceed to the procedure “Editing a CAL FACTOR data file”.

## Working with the Calibration Editor

### Selecting a CAL FACTOR data file

This menu selection is only available when the Calibration Editor program is started automatically.

- If a CAL FACTOR data file **does not exist** for the power sensor that is being used in your test system, one must be created. (Refer to “Creating a new CAL FACTOR data file”.)
- If a CAL FACTOR data file **does exist** for the power sensor that is being used in your test system and you do not need to edit the data in the file, use the **▲** and **▼** arrow keys, to select **SELECT CAL FACTOR FILE** from the POWER SENSOR CAL FACTOR MANAGEMENT menu and press **Return**.

A screen displays all of the stored CAL FACTOR data files currently available in the directory path (MSVS) specified. Using the **▲** and **▼** arrow keys, select an existing CAL FACTOR data file and press **Return**.



## Working with the Calibration Editor

If you fail to load the CAL FACTOR data file that is required for the power sensor that was designated on the Power Sensor Identification menu, a warning screen similar to the following is displayed:

```
The Calibration Editor has been re-started because the
CAL FACTOR data file required for the power sensor designated
on the Power Sensor Identification menu does not match.

...CAL FACTOR data file that was expected:  CF8xxxxxx
...CAL FACTOR data file that was loaded:    CF8yyyyyy

* In order to continue testing, use SELECT CAL FACTOR FILE
  from the Calibration Editor main menu to load the
  CAL FACTOR data file that is expected.

* If you decide to use a different power sensor, you must
  abort the tests, return to the main HHS module selection
  menu, and enter the information for the new power sensor.

* The following data is required to create a new CAL FACTOR data file.

...Model number of power sensor being calibrated:  HP8xxxxx
...Serial number of power sensor being calibrated:  yyyAzzzz
```

To resolve this problem:

- From the Calibration Editor main menu, use SELECT CAL FACTOR FILE to load the expected CAL FACTOR data file.

If you decide to use a different power sensor:

1. Abort the Calibration Editor.
2. Abort the tests menu.
3. Return to the main MMS module selection menu.
4. Enter information for a new power sensor when a test is selected.

If you would like to edit any information for the power sensor being used, select **EDIT CAL FACTOR FILE** from the **POWER SENSOR CAL FACTOR MANAGEMENT** menu and press **(Return)**. (Refer to “Editing a CAL FACTOR data file”.)

## Working with the Calibration Editor

### Editing a CAL FACTOR data file

During this procedure, you can either continue the steps that you started when “Creating a new CAL FACTOR data file”, or you can access an existing CAL FACTOR data file and edit its entries.

Choose one of the following three options:

- If you are continuing from the procedure, “Creating a new CAL FACTOR data file”, proceed to the procedure “Using the POWER SENSOR EDITING menu”.
- If a CAL FACTOR data file **does not exist** for the power sensor that is being used in your test system, one must be created. (Refer to “Creating a new CAL FACTOR data file” located earlier in this chapter.)
- If a CAL FACTOR data file **does exist** for the power sensor that is being used in your test system, you can edit its entries.

Use the **▲** and **▼** arrow keys, to select **EDIT CAL FACTOR FILE** from the POWER SENSOR CAL FACTOR MANAGEMENT menu and press **(Return)**.

A screen displays all of the stored CAL FACTOR data files currently available in the directory path (MSVS) specified. Using the **▲** and **▼** arrow keys, select an existing CAL FACTOR data file and press **(Return)**.

```
CF81A53332
CF81D25332
CF82A49795
CF84A83844
CF85A00137
CF85D01472
```

### Using the POWER SENSOR EDITING menu

```
=====POWER SENSOR EDITING=====
=====
=HP8481D (ID=0246A02928) CAL FACTORS=
EDIT REFERENCE CAL FACTOR   100.00 %
EDIT CAL FACTORS
EDIT FREQUENCY LIST
EDIT CAL DUE DATE
```

**EDIT REFERENCE CAL FACTOR**

Use this selection to enter or change the reference calibration factor as it is listed on the power sensor being used.

**EDIT CAL FACTORS**

Use this selection to enter or change the calibration factors associated with the entered frequencies of the power sensor being used.

## Working with the Calibration Editor

Choosing this selection displays a list of frequencies and their associated calibration factors that are presently stored in the CAL FACTOR data file being edited.

1.000	GHZ	100.00 %
2.000	GHZ	99.00 %
4.000	GHZ	100.00 %
6.000	GHZ	100.00 %
8.000	GHZ	100.00 %
10.000	GHZ	100.00 %
12.000	GHZ	100.00 %
14.000	GHZ	96.00 %
16.000	GHZ	100.00 %
18.000	GHZ	100.00 %

- Use **▲** or **▼** to highlight a frequency.
- Press **Return** to move the cursor to the right-hand column.
  - To select the various fields, use the **◀** or **▶** arrow keys to move the cursor.
  - To change a value, use the **▲** or **▼** arrow keys.

Press **Return** when you are finished editing the values.
- Press **▼** to proceed to the next screen.

A dialog box asks if you would like to store the modified calibration factors.

## EDIT FREQUENCY LIST

Use this selection to enter or change the frequencies listed for the power sensor being used.

A menu screen displays the frequencies that are currently stored for your power sensor.

1.000	GHZ
2.000	GHZ
4.000	GHZ
6.000	GHZ
8.000	GHZ
10.000	GHZ
12.000	GHZ
14.000	GHZ
16.000	GHZ
18.000	GHZ

- Use **▲** or **▼** to highlight the frequency that you wish to change.
- Press **Return** to display an editing submenu.

ADD
INSERT
DELETE
EDIT

## Working with the Calibration Editor

3. Use  or  to highlight your choice and press .
  - To select the various fields, use the  or  arrow keys to move the cursor.
  - To change a value, use the  or  arrow keys.

Press  when you are finished editing the values.

4. Press  to proceed to the next screen.

A new dialog box asks if you wish to edit the calibration factors associated with any entries that you have made.

```

Do you want to edit the CAL FACTORS?  YES
                                       NO
  
```

- If you select **YES**, a screen lists the new edited frequencies with their presently associated calibration factors. Refer to EDIT CAL FACTORS for steps on editing CAL FACTOR data files.

### EDIT CAL DUE DATE

Use this selection to enter or change the calibration due date of the power sensor being used.

The power sensor information screen is displayed.

```

=====POWER SENSOR INFORMATION=====
POWER SENSOR MODEL      HP8481D
POWER SENSOR SERIAL     0246A02928
POWER SENSOR CAL DUE    13 June 199x
  
```

1. Use the  and  arrow keys to select **POWER SENSOR CAL DUE**.

## Working with the Calibration Editor

If you enter the current date or a date earlier than the current date as the POWER SENSOR CAL DUE entry, module verification software will view the power sensor as overdue for calibration. This will start the Calibration Editor program and display a warning screen similar to the following:

```
The Calibration Editor has been started because the power sensor designated
on the Power Sensor Identification menu has past its calibration due date.

...CAL FACTOR data file that is out of date:  CF8xxxxxxx

* If the currently selected power sensor has been recalibrated and new
  calibration data is available, you can edit the CAL FACTOR data file
  listed above using the EDIT CAL FACTOR FILE selection.

* If there is no new calibration data for the current power sensor, select a
  different power sensor and its corresponding CAL FACTOR data file by
  aborting the tests and returning to the main MMS module selection menu.

* If you decide to edit other CAL FACTOR data files, other than the one listed
  above, assure that the last CAL FACTOR data file loaded is the one that is
  to be used during testing. Failure to do this will produce an error.
```

To resolve this problem:

- a. If the currently selected power sensor has been recalibrated and new calibration data is available, use the Calibration Editor to edit the calibration data in the CAL FACTOR data file listed above:
  - i. Use EDIT CAL FACTOR FILE available from the POWER SENSOR CAL FACTOR MANAGEMENT menu.
  - ii. Use EDIT CAL FACTORS available from the POWER SENSOR EDITING menu.
- b. If there is no new calibration data for the current power sensor, select a different power sensor and its corresponding CAL FACTOR data file.

If you decide to use a different power sensor:

- i. Abort the Calibration Editor.
- ii. Abort the tests menu.
- iii. Return to the main MMS module selection menu.
- iv. Enter information for a new power sensor.

You can not simply change the POWER SENSOR MODEL or the POWER SENSOR SERIAL on the POWER SENSOR INFORMATION menu, you must return to the main MMS module selection menu and enter the information for the new power sensor.

---

**Note**

If you decide to use other functions of the Calibration Editor or edit other CAL FACTOR data files, other than the one listed above, you must make sure that the last CAL FACTOR data file that is loaded is the one that is to be used during testing or an error message will be displayed; this only occurs when the Calibration Editor is entered automatically.

---

## Working with the Calibration Editor

If you fail to load the CAL FACTOR data file that is required for the power sensor that was designated on the Power Sensor Identification menu, a warning screen similar to the following is displayed:

```
The Calibration Editor has been re-started because the
CAL FACTOR data file required for the power sensor designated
on the Power Sensor Identification menu does not match.

...CAL FACTOR data file that was expected:  CF8xxxxxx
...CAL FACTOR data file that was loaded:    CF8yyyyyy

* In order to continue testing, use SELECT CAL FACTOR FILE
  from the Calibration Editor main menu to load the
  CAL FACTOR data file that is expected.

* If you decide to use a different power sensor, you must
  abort the tests, return to the main HHS module selection
  menu, and enter the information for the new power sensor.

* The following data is required to create a new CAL FACTOR data file.

...Model number of power sensor being calibrated:  HP8xxxxx
...Serial number of power sensor being calibrated:  yyyAzzzz
```

To resolve this problem:

- From the Calibration Editor main menu, use SELECT CAL FACTOR FILE to load the expected CAL FACTOR data file.

If you decide to use a different power sensor:

- a. Abort the Calibration Editor.
  - b. Abort the tests menu.
  - c. Return to the main MMS module selection menu.
  - d. Enter information for a new power sensor.
2. When finished editing, press **(Return)**.

**Printing a CAL FACTOR data file**

- If a CAL FACTOR data file **does not exist** for the power sensor that is being used, one must be created. (Refer to “Creating a new CAL FACTOR data file”.)
- If a CAL FACTOR data file **does exist** for the power sensor that is being used, use the **▲** and **▼** arrow keys to select **PRINT CAL FACTOR FILE** from the **POWER SENSOR CAL FACTOR MANAGEMENT** menu and press **Return**.

A screen displays all of the stored CAL FACTOR data files currently available in the directory path (MSVS) specified. Using the **▲** and **▼** arrow keys, select an existing CAL FACTOR data file and press **Return**.



A screen displays options for directing the output of the contents of a CAL FACTOR data file.

1. Using the **▲** and **▼** arrow keys, select **CRT**, **LOCAL PRINTER**, or **PRINT SPOOLER** and press **Return**.
2. Press **▼** to print the file.



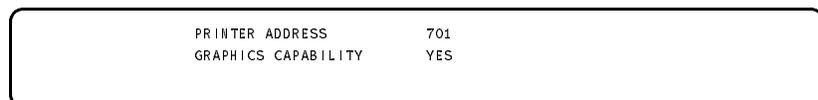
**CRT**

Choosing **CRT** displays the contents of the currently selected CAL FACTOR data file to the display screen.

**LOCAL PRINTER**

Choosing **LOCAL PRINTER** displays a screen that requests printer information before sending data to a local printer.

If you're using an HP-IB printer, it must be set to address 01 and can only be used with select code 7. This means that, an HP-IB printer can only be used when it is set to HP-IB address 701; module verification software will not recognize an HP-IB printer at any other address.



## Working with the Calibration Editor

PRINT SPOOLER

Choosing **PRINT SPOOLER** displays a screen that requests the MSVS or directory path of the print spooler.

Enter the SRM or UNIX print spooler path.  
(For example, LP:REHOTE or | lp.)

## Purging a CAL FACTOR data file

- If a CAL FACTOR data file **exists** for the power sensor that is being used, use the **▲** and **▼** arrow keys to select **PURGE CAL FACTOR FILE** from the **POWER SENSOR CAL FACTOR MANAGEMENT** menu and press **(Return)**.

A screen displays all of the stored CAL FACTOR data files currently available in the directory path (MSVS) specified. Using the **▲** and **▼** arrow keys, select an existing CAL FACTOR data file and press **(Return)**.

CF81A53332  
CF81D25332  
CF82A49795  
CF84A83844  
CF85A00137  
CF85D01472

### Changing the CAL FACTOR data file volume (MSVS)

1. Using the **▲** and **▼** arrow keys, select **CHANGE CAL FACTOR VOL** from the **POWER SENSOR CAL FACTOR MANAGEMENT** menu and press **Return**.

```
=====Enter the CAL FACTOR volume MSVS=====
/0PV9000/70909A_10A/CALFACTORS
```

- Press **Return** if the directory path (MSVS) being displayed is the correct location of the power sensor CAL FACTOR data files in your file system. This directory path (MSVS) is saved in the MS\_TABLE data file.
- If CAL FACTOR data files are located in a different directory path (MSVS) than the one that is displayed, enter the directory path (MSVS) that you wish the Calibration Editor to search and press **Return**.

For example, /0PV9000/70909A\_10A/CALFACTORS is the default directory path (MSVS) that was specified in the MS\_TABLE data file. Changing the directory path (MSVS) using this menu selection changes the location of where CAL FACTOR data files are searched for in your file system.

Changing the directory path (MSVS) in this procedure also changes the directory path (MSVS) used by the MS\_TABLE data file. (For further information, refer to “Working with the MS\_TABLE Data File” in Chapter 2.)

### Exiting the Calibration Editor

1. Using the **▲** and **▼** arrow keys, select **EXIT** from the **POWER SENSOR CAL FACTOR MANAGEMENT** menu and press **Return**.

A dialog screen asks you if you wish to exit the Calibration Editor.

- Select YES to return to the module verification test that you previously selected.
- Select NO to return to the Calibration Editor and to view or modify information.
- Select ABORT to go to the test list and make a new test selection.



## Test Equipment and Calibrations

---

### Overview    In this chapter you will learn about:

- Test equipment requirements and their setup configurations
  - Test equipment calibrations as well as when and how often calibrations are required
  - External frequency reference requirements
- 

This chapter contains the test equipment setups for all calibration procedures that must be performed in order to optimize module performance when assemblies are changed, repaired, or adjusted. You will learn about the requirements as well as when and how often calibrations are required. Finally, you'll learn about the requirements for the external frequency reference being used.

Test Equipment Requirements .....	4-2
Test Equipment Calibrations .....	4-5
External Frequency Reference Requirements .....	4-9

## Test Equipment Requirements

The *HP 70909A/70910A module verification software* only contains drivers for the equipment shown in the table below. The equipment is listed in order of preferred model number.

In all cases, the specified aging rate requirement is  $10^{-9}$  ms/day. The microwave source, synthesized source, and calibrated spectrum analyzer listed in the following table have internal time bases that meet the aging rate requirement.

Equipment	TSCRIPT Label	Default HP-IB Address	Recommended Model
<b>Controller</b>		NONE	HP 9000 Series 300 controller (SELECT CODE 7 or 8.) <sup>1</sup>
<b>Signal Sources</b>			
Full microwave source	SYN1 <sup>2, 3, 4</sup>	727	HP 83630A/B Option 001 and 008 synthesized sweeper, or HP 83640A/B Option 001 and 008 synthesized sweeper, or HP 83650A/B Option 001 and 008 synthesized sweeper, or HP 8340B synthesized sweeper, or HP 8340A synthesized sweeper
Microwave source	SYN2 <sup>2, 4</sup>	715	HP 83630A/B Option 001 and 008 synthesized sweeper, or HP 83640A/B Option 001 and 008 synthesized sweeper, or HP 83650A/B Option 001 and 008 synthesized sweeper, or HP 8340B synthesized sweeper, or HP 8340A synthesized sweeper
Synthesized source	SYN3	725	HP 8662A synthesized signal generator, or HP 8663A synthesized signal generator
Level generator	LG1	704	HP 3335A synthesizer/level generator
<b>Analyzers</b>			
Calibrated spectrum analyzer	SA1	728	HP 8566B spectrum analyzer (upgraded with firmware version 16.7.85 or later)
Scalar network analyzer	NA1 <sup>2, 3, 4</sup>	726	HP 8757D scalar network analyzer, or HP 8757C scalar network analyzer, or HP 8757B scalar network analyzer, or HP 8757A scalar network analyzer

1 To determine the proper select code, refer to “Connecting test equipment HP-IB interface cables” in Chapter 2. If SELECT CODE 8 is used, all default addresses listed in the above table should be set with an 8xx HP-IB address, as opposed to 7xx. TSCRIPT addresses must also be updated to reflect these changes.

2 The difference between the full microwave source and the microwave source is that *the full microwave source is the combination of a microwave source coupled with a scalar network analyzer.*

3 To communicate with the full microwave source, when being used with a scalar network analyzer, HP-IB commands must be passed through the scalar network analyzer’s system interface bus (private bus) to the full microwave source. In order to accomplish this, the scalar network analyzer’s (internal) SWEEPER address and the HP-IB address of the full microwave source must be set to the same address. When using this version of module verification software, the scalar network analyzer’s (internal) SWEEPER address and the HP-IB address of the full microwave source must both be set to 19; this is hard-coded in the module verification software and can not be changed. (For further information, refer to the section “To specify SWEEPER and HP-IB addresses” in Chapter 2.)

4 If using an HP 8360 Series synthesized sweeper for SYN1 or SYN2 (as designated in TSCRIPT), it must be placed in HP 8340 Compatibility Mode. (Refer to the procedure, “To set the HP 8360 Series Synthesized Sweeper to HP 8340 Compatibility Mode” in Chapter 2.)

## Test Equipment Requirements

Equipment	TSCRIPT Label	Default HP-IB Address	Recommended Model
<b>HP 70000 Components</b>			
Local oscillator source	SYN4	718	HP 70900B local oscillator source (upgraded with firmware version 911021 [V.U.F. B.04.01] or later) or HP 70900A local oscillator source (upgraded with firmware version 911021 [V.U.F. B.04.01] or later)
Display			HP 70004A color display
Mainframe			HP 70001A mainframe
IF section			HP 70902A IF section
Module Extender			HP 70001-60013 extender module
Frequency reference			Refer to "External Frequency Reference Requirements".
<b>Meters</b>			
Noise source	NSRC	NONE	HP 346C broadband noise source
Noise figure meter	NMTR1	708	HP 8970B noise figure meter, or HP 8970A noise figure meter
Power meter	PM1 <sup>1,2</sup>	713	HP 436A power meter (2 required), or HP 438A dual-channel power meter
	PM2 <sup>1,2</sup>	712	HP 436A power meter (2 required), or HP 438A dual-channel power meter
Power sensor	MWPS	NONE	HP 8485A APC-3.5 mm(m) power sensor
	LPPS	NONE	HP 8481D N(m) power sensor, or HP 8484A N(m) power sensor, or HP 8485D APC-3.5 mm(m) power sensor
	LFPS	NONE	HP 8482A N(m) power sensor, or HP 8481A N(m) power sensor
Precision DVM	DVM	722	HP 3456A digital multimeter, or HP 3457A digital multimeter

1 When using an HP 436A power meter, the ADDRESS TYPE must be specified as HP-IB (as designated in TSCRIPT).

2 When using an HP 438A dual-channel power meter, the ADDRESS TYPE must be specified as OTHER (as designated in TSCRIPT). The format that is used on the HP-IB address consists of three numbers separated by commas (713,0,0). The first number designates HP-IB address 713, followed by 0, followed by a 0 (selecting channel A) or a 1 (selecting channel B). For example, 713,0,0 designates channel A while 713,0,1 designates channel B.

## Test Equipment Requirements

<p><b>Amplifiers</b>            HP 83006A microwave amplifier            HP 8447A RF amplifier,              or HP 8447D RF amplifier,              or HP 8447E RF amplifier,              or HP 8447F RF amplifier</p>
<p><b>Standard Equipment</b>            HP 8493C Option 006 coaxial fixed attenuator            HP 8493C Option 010 coaxial fixed attenuator            HP 11667B power splitter            HP 909D Option 011 50Ω 3.5 mm(f) termination            HP 11636B power divider/combiner            HP 85025B detector (2 required),              or HP 85025E detector (2 required)</p>
<p><b>Accessory Equipment</b>            HP 0955-0204 microwave isolator            HP 87421A power supply</p>
<p><b>Cables</b>            HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m) (6 required)            HP 8120-5022 365 mm SMB(f) to SMB(f) (5 required)            HP 5061-9038 520 mm SMA(m) to SMA(m)            HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m) (3 required)            HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f) (2 required)</p>
<p><b>Adapters</b>            HP 1251-2277 50Ω BNC(f) to dual banana plug            HP 1250-1236 50Ω SMB(f) to BNC(f)            HP 1250-0674 50Ω SMB(m) to SMA(f)            HP 1250-1158 50Ω SMA(f) to SMA(f) (2 required)            HP 1250-1292 50Ω BNC(f) to alligator clips            HP 1250-0672 50Ω SMB(f) to SMB(f)            HP 1250-1159 50Ω SMA(m) to SMA(m) (2 required)            HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f) (2 required)            HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m) (2 required)            HP 1250-1750 50Ω APC-3.5(m) to N(f)            HP 1250-1744 50Ω APC-3.5(f) to N(m) (2 required)</p>
<p><b>HP 70000 system service kit HP 71000-60002<sup>1</sup></b>            HP 70001-60013 extender module            HP 70001-00038 right modified mainframe cover            HP 70001-00039 left modified mainframe cover            HP 5021-6773 cable puller            HP 8710-1651 short 8 mm hex-ball driver<sup>2</sup>            HP 8710-1728 bandpass filter tuning tool<sup>2</sup>            HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f) (three)<sup>2</sup>            HP 5061-9021 390 mm SMB(f) to SMB(f) (seven)            HP 8160-0495 chromeric gasket (two feet)            HP 5021-7445 connector pin straightener</p>
<p><b>Accessory Service Tools</b>            HP 8710-0033 nonmetallic tuning tool            HP 8710-1791 ceramic adjustment tool            HP 08555-20097 5/16 inch modified box wrench</p>

<sup>1</sup> This kit includes servicing tools used to repair all HP 70000A modular spectrum analyzer modules, and a modification procedure for the HP 70001A mainframe which allows access to modules during bench testing and repair. This kit does not cover all MMS products.

<sup>2</sup> This part is required during servicing for the HP 70909A or HP 70910A RF section.

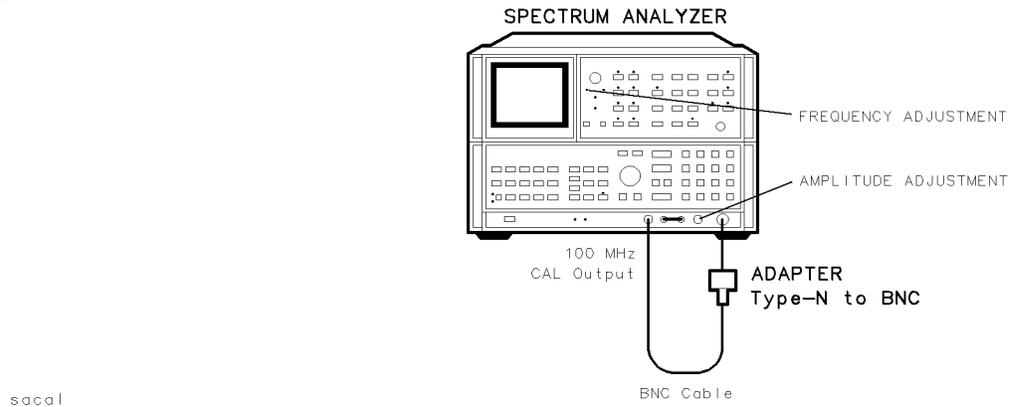
## Test Equipment Calibrations

The module verification tests require spectrum analyzer instrument calibration and scalar network analyzer flatness calibration. These calibrations store calibration data for verification tests measurement-correction in controller common memory.

The RF section module verification software automatically initiates and executes the Electronic Test Equipment (ETE) calibration routines and verifies the presence of calibration factors for the required test equipment.

The scalar network analyzer flatness calibration is required prior to running Test 03. Gain and Flatness Calibration. Spectrum analyzer instrument calibration is required before any test that uses the HP 8566B spectrum analyzer. These two calibrations can be accessed through the Test Equipment Calibration Menu.

## Spectrum Analyzer Calibration



**Figure 4-1. Spectrum Analyzer Calibration Setup**

The purpose of this procedure is to calibrate the HP 8566B spectrum analyzer.

- Connect the equipment as shown in the Spectrum Analyzer Calibration setup.
- Module verification software executes the Recall 8 command (–10 dBm amplitude adjustment at 100 MHz), and the Recall 9 command (100 MHz frequency zeroing adjustment).

After the HP 8566B spectrum analyzer has had Recall 8 and Recall 9 adjustments performed, it may be used in the test system.

Flatness Calibration

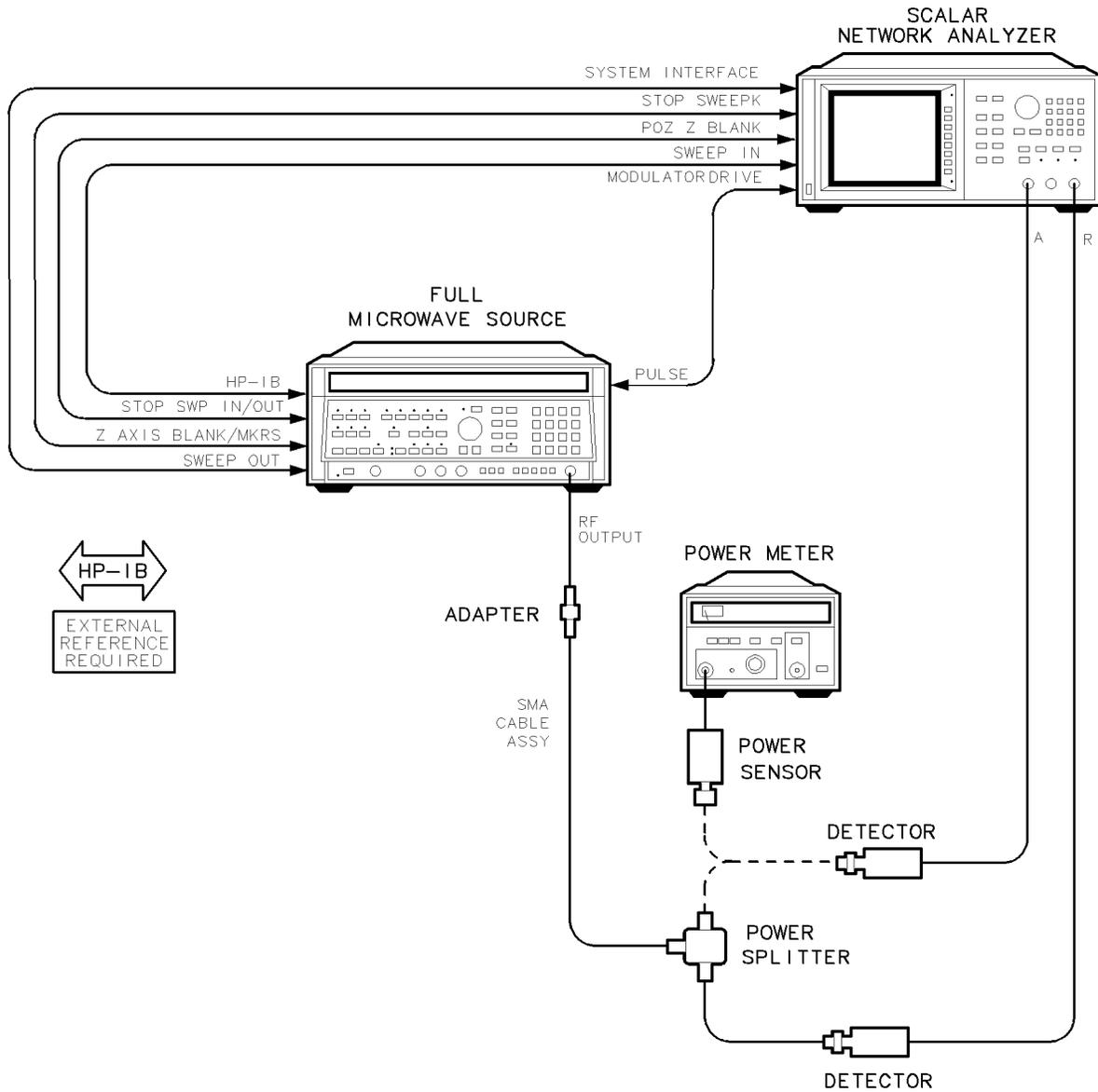


Figure 4-2. Flatness Calibration and Verification Test Setup

Test Equipment

Preferred Model Numbers

Full microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Microwave network analyzer .....	HP 8757D scalar network analyzer
External reference .....	Refer to "External Frequency Reference Requirements".
Power meter .....	HP 436A power meter
Power splitter .....	HP 11667B power splitter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Detector (2 required) .....	HP 85025B detector
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

### Flatness Calibration

The purpose of this procedure is to characterize the test system with a network analyzer and a power meter.

- Connect the equipment as shown in the Flatness Calibration Equipment Setup.
- After the network analyzer channel A detector takes a reading, remove the channel A detector from the power splitter and attach the power splitter to the power sensor.

The full microwave source is set to 321.4 MHz. The network analyzer channel A detector is connected to the power splitter and a reading is noted. A power sensor is connected to the power splitter in place of the network analyzer channel A detector and a reading is again noted.

The full microwave source is set to 300 MHz and a power level that will yield a calibrated power meter reading equal to the UUT input power. The power level setting of the full microwave source is noted and stored. The full microwave source increments in discrete steps from 50 MHz to 26.5 GHz while the power meter measures the power level. This measurement generates data for use in calculating the correction factors.

A formula calculates the correction factors using the two sets of data. The correction data is then stored in common memory and used to calculate the module gain in Test 03. Gain and Flatness Calibration.

---

## External Frequency Reference Requirements

Most module verification tests and adjustment setups for the HP 70909A RF section and HP 70910A RF section require an external frequency reference. When running these tests, the HP 70900A/B local oscillator source and instruments such as sources and analyzers must be connected to the same frequency standard.

In all cases, the specified aging rate requirement is  $10^{-9}$ /day. The microwave source, synthesized source, and calibrated spectrum analyzer each have an internal time base that meets the aging rate requirement.

### 10 MHz Generation

The 10 MHz internal frequency reference of an HP 8662A synthesized signal generator is used as the system reference. This method minimizes phase noise associated with chaining the same reference signal through several devices; it ensures that the last instruments in the chain receives reference signals of sufficient amplitude. The HP 8721A directional bridge splits the reference signal and ensures good isolation between the two reference signal paths.

---

**Note** The rear panel 10 MHz OUTPUT of the HP 3335A synthesizer/level generator lacks the spectral purity required for most applications as a frequency reference, and should not be connected to other test equipment.

---

### 100 MHz Generation

The HP 70900A/B local oscillator source requires a 100 MHz external reference. There are two equipment configurations used to generate the 100 MHz signal for the local oscillator:

**Preferred** Figure 4-3 shows the preferred method of connecting a test system to a 10 MHz standard.

The HP 70310A precision frequency reference receives a 10 MHz input, through the directional bridge, from the synthesizer. This signal is used to phase-lock the 100 MHz VCO oscillator, in the HP 70310A precision frequency reference, which is then used as the input for the HP 70900A/B local oscillator source.

**Alternate** Using an HP 8566B spectrum analyzer as the 100 MHz frequency standard.

In Figure 4-4 the 100 MHz signal required by the HP 70900A/B local oscillator source comes from the HP 8566B spectrum analyzer 100 MHz calibrator output. The 10 dB pad prevents RF amplifier saturation. The RF amplifier must have a gain of at least 20 dB at 100 MHz.

External Frequency Reference Requirements

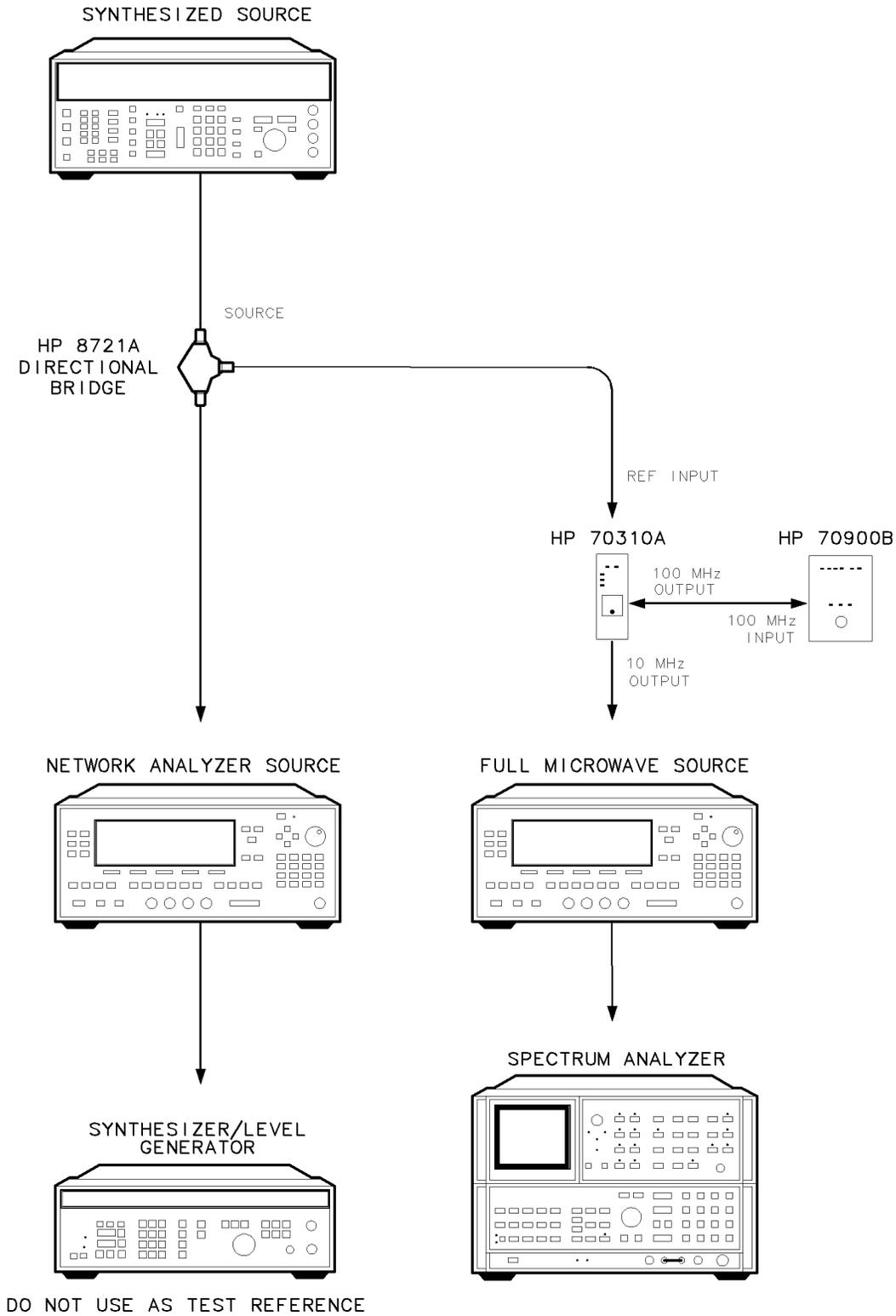
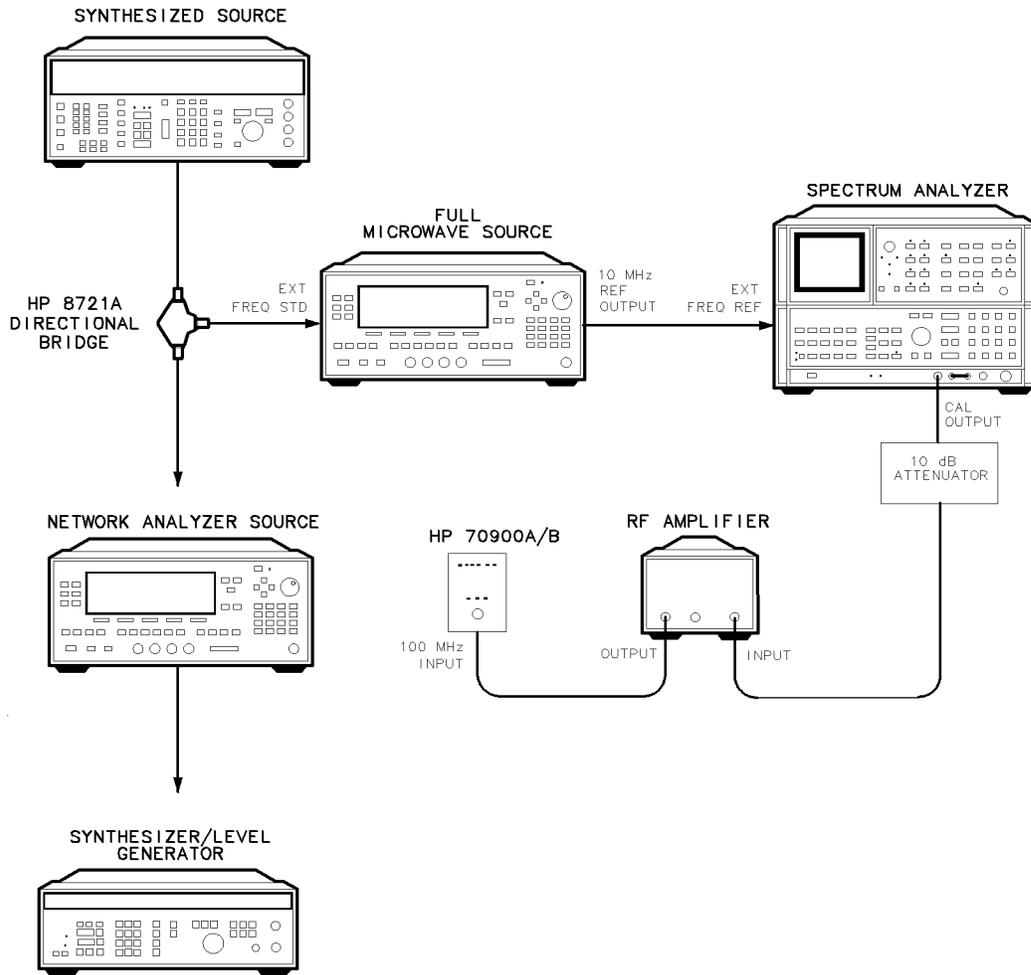


Figure 4-3.

Frequency Reference Connections, Using an HP 70310A Precision Frequency Reference

sua3\_2t\_d

External Frequency Reference Requirements



epa3\_4t

Figure 4-4. Frequency Reference Connections, Using the HP 8566B Spectrum Analyzer



## Adjustment Procedures

---

### Overview In this chapter you will learn about:

- Which equipment is required for each adjustment by viewing an “Adjustment Equipment Matrix”
  - Each of the equipment setups used during module adjustments
- 

This chapter contains the test equipment setups for all adjustment procedures that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated and require a controller running module verification software.

Before You Begin Adjustments .....	5-2
Overall Adjustment Setup .....	5-4
Adjustment 01. Power Supply Voltage Checks .....	5-5
Adjustment 02. 1st LO Power .....	5-7
Adjustment 03. 2nd Converter Adjustments Menu .....	5-10
Adjustment 03.01 VCO Tune-Line Voltage .....	5-11
Adjustment 03.02 VCO Frequency and Amplitude .....	5-13
Adjustment 03.03 2nd Converter LO Feedthrough .....	5-15
Adjustment 03.04 Sampler DC IF Out .....	5-17
Adjustment 03.05 Sampler AC IF Out .....	5-19
Adjustment 03.06 Search Oscillator Duty Cycle and Period .....	5-21
Adjustment 03.07 Search Oscillator Square Wave Min/Max .....	5-23
Adjustment 03.08 Search Oscillator VCO Tune Line .....	5-25
Adjustment 03.09 Phase Lock .....	5-27
Adjustment 03.10 VCO Tune Range .....	5-29
Adjustment 03.11 Lock Range Measurement .....	5-32
Adjustment 03.12 Bandpass Filter and VCO Tune Range Final .....	5-34
Adjustment 03.13 Mixer Bias .....	5-37
Adjustment 04. Last Converter Alignment .....	5-39
Adjustment 05. PGA Calibration .....	5-44
Adjustment 06. YTF Alignment .....	5-46

---

**Note** 2nd converter adjustments must be run in the order specified; do not run them out of order.

---

## Before You Begin Adjustments

Adjustments / Equipment	LO Source	Full $\mu$ W Source	Scalar Network Analyzer	$\mu$ W Source	Synth. Source	Level Generator	Power Meter #1	$\mu$ W Power Sensor	Power Meter #2	Low Power Power Sensor	Low Freq. Power Sensor	DVM	Calibrated Spectrum Analyzer	Noise Figure Meter	Noise Source
	SYN4	SYN1	NA1	SYN2	SYN3	LG1	PM1	MWPS	PM2	LPPS	LFPS	DVM	SA1	NMTR1	NSRC
Test Equipment Calibration Menu		X	X				X								
Adj. 01. Power Supply Voltage Checks	X						X					X			
Adj. 02. 1st LO Power	X			X			X	X				X			
Adj. 03. 2nd Converter Adjustments Menu	X	X	X	X	X		X	X				X	X		
Adj. 04. Last Converter Alignment	X	X	X		X		X	X					X		
Adj. 05. PGA Calibration	X														
Adj. 06. YTF Alignment	X	X	X	X		X						X			

HP 70909A/70910A  
 amatrix.cdr  
 Rev. 1  
 10/13/97

**Figure 5-1. Adjustments Equipment Matrix**

**Recommended Test Equipment**

For a list of test equipment, accessories, and related critical specifications, refer to “Test Equipment Requirements”, in Chapter 2 or Chapter 4. For a list of ESD accessories, refer to “Preparing a Static-Safe Work Station” in Chapter 7. Never force an adjustable component, especially slug-tuned inductors or variable capacitors.

If you remove the cover of the 2nd converter to make an adjustment, replace it with the 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

**Overall Adjustment Setup**

The basic overall setup in Figure 5-2 is applicable to most RF section adjustment tests. Adjustments require that the HP 70909A or HP 70910A RF section, often referred to in the adjustments as the UUT (unit-under-test), be connected to an extender cable.

---

**CAUTION** To avoid connector damage, a blown mainframe line fuse, or a blown module fuse, the mainframe main power switch must be set to OFF before connecting or disconnecting the extender module cable.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in the equipment setup.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run the appropriate adjustment routine. (Refer to Chapter 3 for information about running module verification software.)

**HP-IB Symbol**

The Hewlett-Packard Interface Bus (HP-IB) symbol on adjustment setup diagrams indicates that the controller and other instruments must link together by means of HP-IB.

**External Frequency Reference**

The external reference symbol on an adjustment setup diagram indicates that the HP 70000 Series modular spectrum analyzer system and equipment such as sources, analyzers, and frequency counters must connect to the same frequency standard. (Refer to “External Frequency Reference Requirements” in Chapter 4.)

## Overall Adjustment Setup

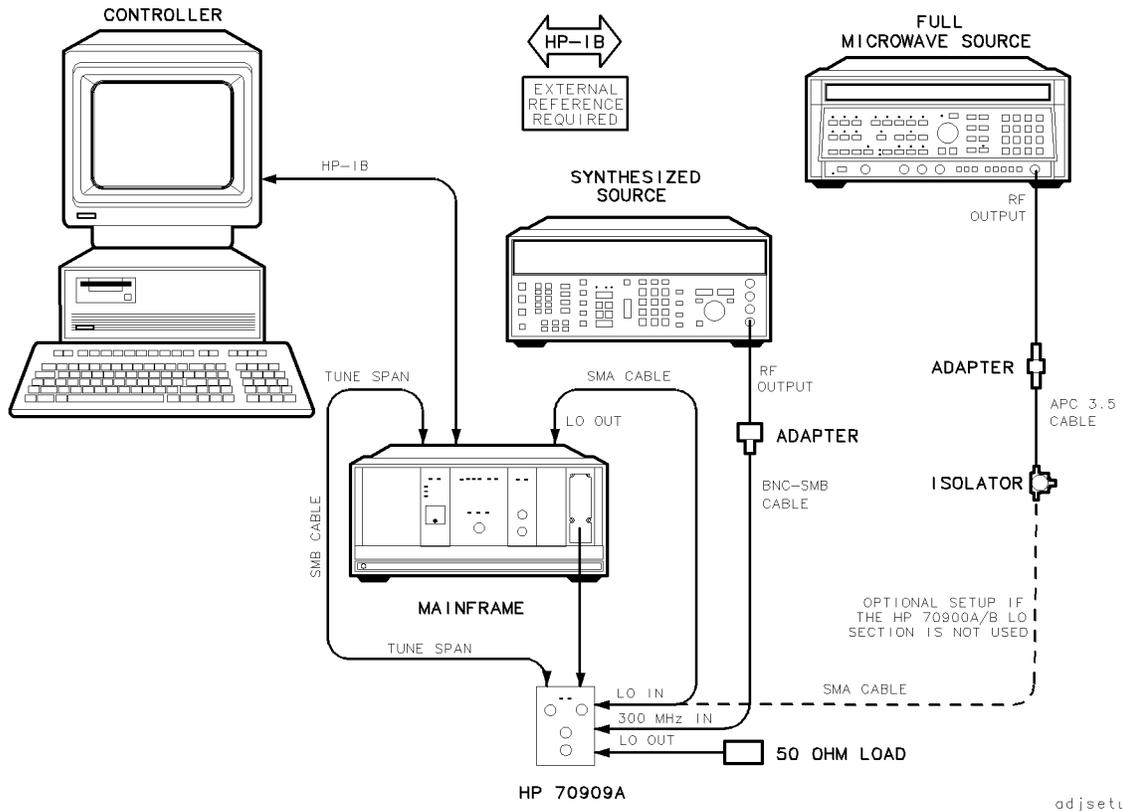


Figure 5-2. Overall Adjustment Equipment Setup

### Test Equipment

### Preferred Model Numbers

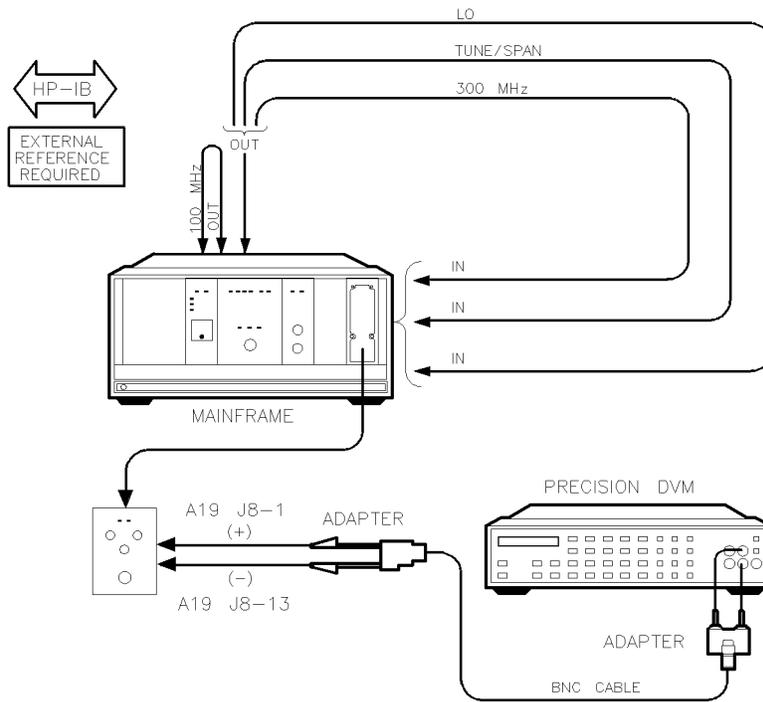
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Cable .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Adapter .....	HP 1250-0780 50Ω N(m) to BNC(f)

For the optional LO setup, add the following test equipment:

Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Isolator .....	HP 0955-0204 microwave isolator
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The basic overall setup in Figure 5-2 is applicable to most RF section adjustment tests. The adjustment setups do not generally show the LO and the Tune Span connections.

Adjustment 01. Power Supply Voltage Checks



SCB9

Figure 5-3. Equipment Setup for Adjustment 01. Power Supply Voltage Checks

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module .....	HP 70001-60013 extender module

### Adjustment 01. Power Supply Voltage Checks

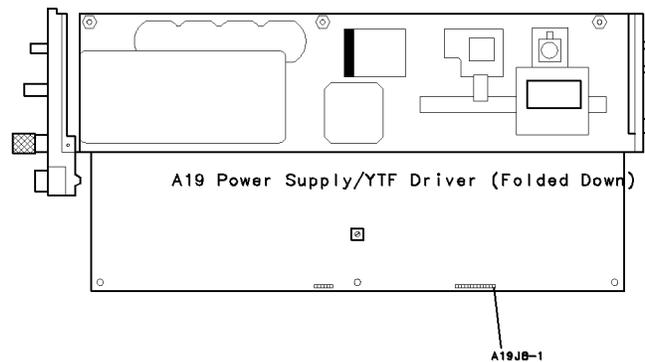
The purpose of this adjustment procedure is to verify that the power supply voltages on the A19 power supply/YTF driver are correct before any adjustments are performed.

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-3.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 01. Power Supply Voltage Checks. (Refer to Chapter 3 for information about running module verification software.)

The UUT is tuned to a center frequency of 26.5 GHz and a span of 0 Hz. The voltmeter is set to the 100 volt range. After the voltage on the A19J8-1 is measured and noted, the voltmeter is connected to all of the other power supply test points. If all voltage values are within the specified limits, they are stored in EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

---

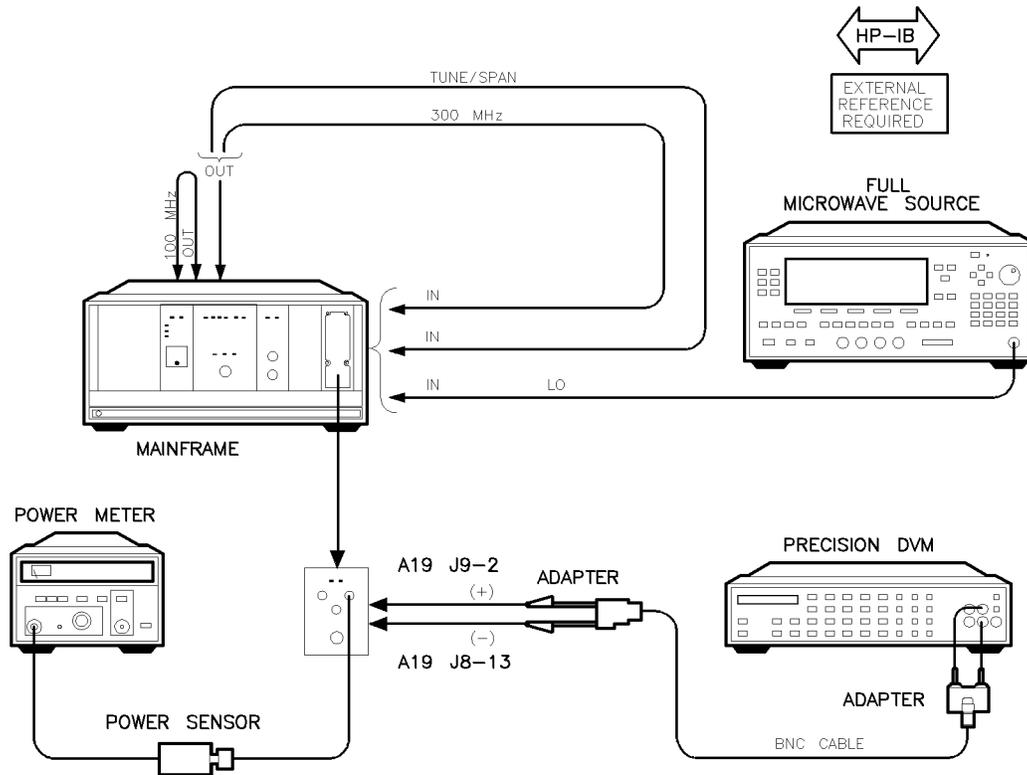
**Note** A19J8-1 is located toward the rear of the RF section.



019J81

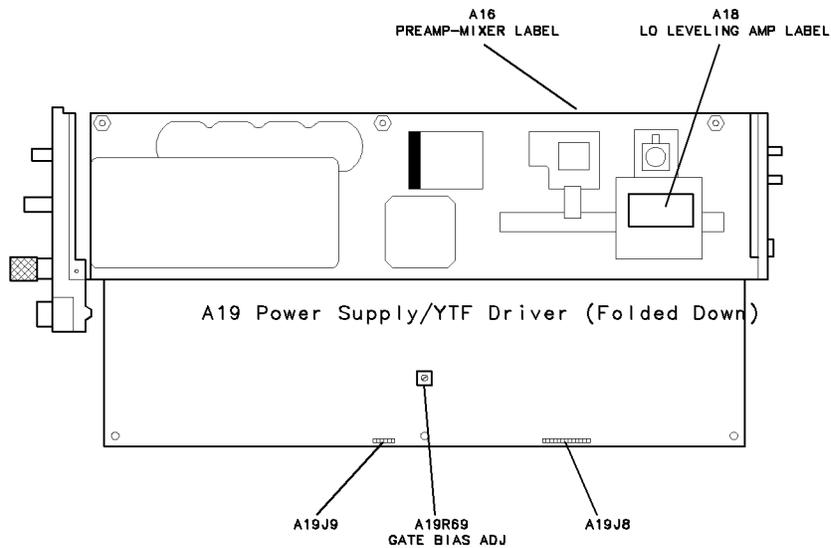
**Figure 5-4. Location of A19J8-1**

Adjustment 02. 1st LO Power



SCB10

Figure 5-5. Equipment Setup for Adjustment 02. 1st LO Power



loadj

Figure 5-6. Side View Location of Adjustment 02. 1st LO Power

**Adjustment 02. 1st LO Power**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter .....	HP 1250-1158 50Ω SMA(f) to SMA(f)
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to set the control voltages for the A18 LO leveling amplifier.

Proper adjustment of these control voltages is essential to assure that the RF section will meet or exceed its specifications for:

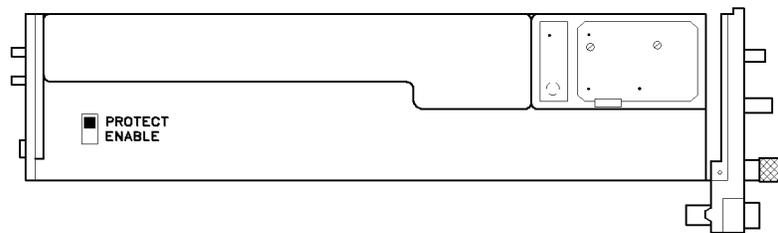
- Front Panel LO Output Power
- Aux LO Output Power
- TOI
- SHI
- Gain
- Flatness
- Noise Figure/D.A.N.L.

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-5.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 02. 1st LO Power. (Refer to Chapter 3 for information about running module verification software.)

**Setting the gate bias voltage**

1. Connect the DVM to the gate bias test point A19J9 pin 2.
2. Adjust the voltage at A19J9-2 using A19R69 to set the gate bias equal to the value listed on the LO leveling amplifier  $\pm 0.005$  V.

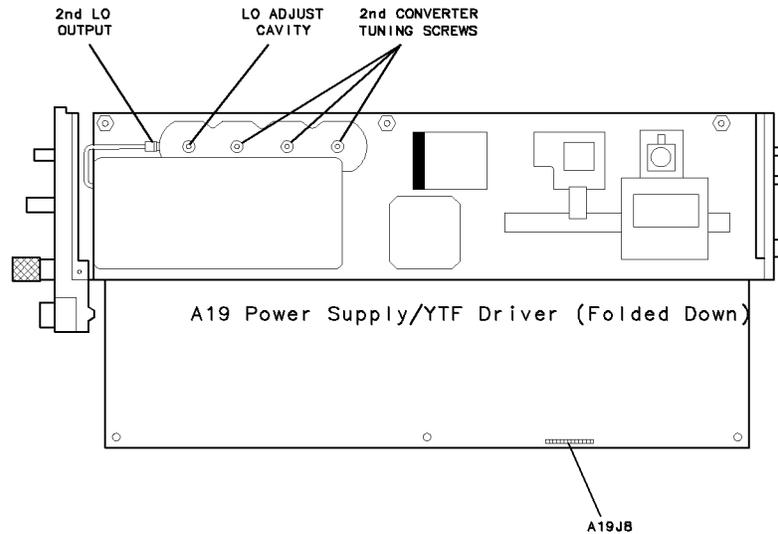
This adjustment generates DAC values for minimum and maximum leveled power for the 1L-, 2L-, and 4L+ bands. The required power level for each band is printed on the top casting, near A16 preamp/mixer and you enter this value while the adjustment is being performed. The microwave source sweeps from 3 to 6.6 GHz to check for unlevel conditions. Optimum DAC values are found and written into the DUT EEPROM.



protect.

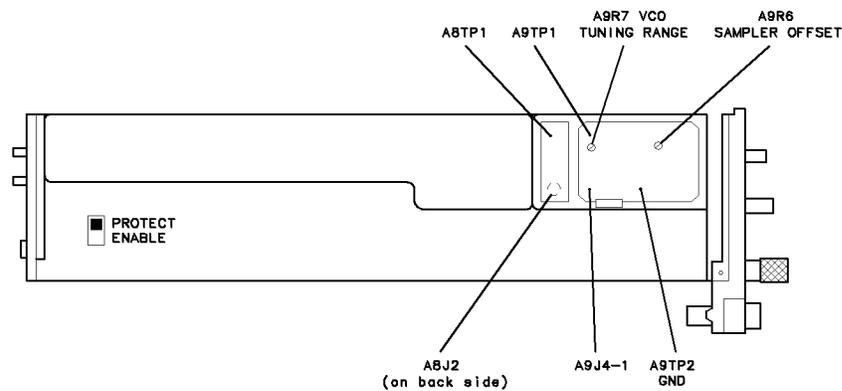
**Figure 5-7. PROTECT/ENABLE Switch Location**

## 2nd Converter Adjustments



scadj1

**Figure 5-8. 2nd Converter Adjustment Locations**



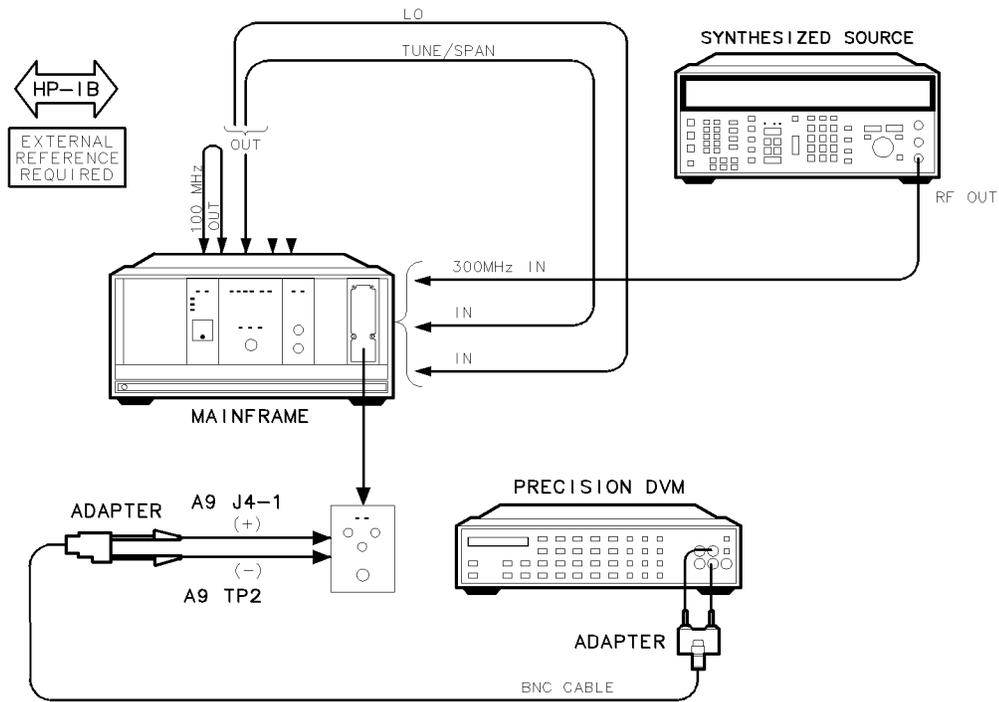
scadj2

**Figure 5-9. 2nd Converter Adjustment Locations**

### Note

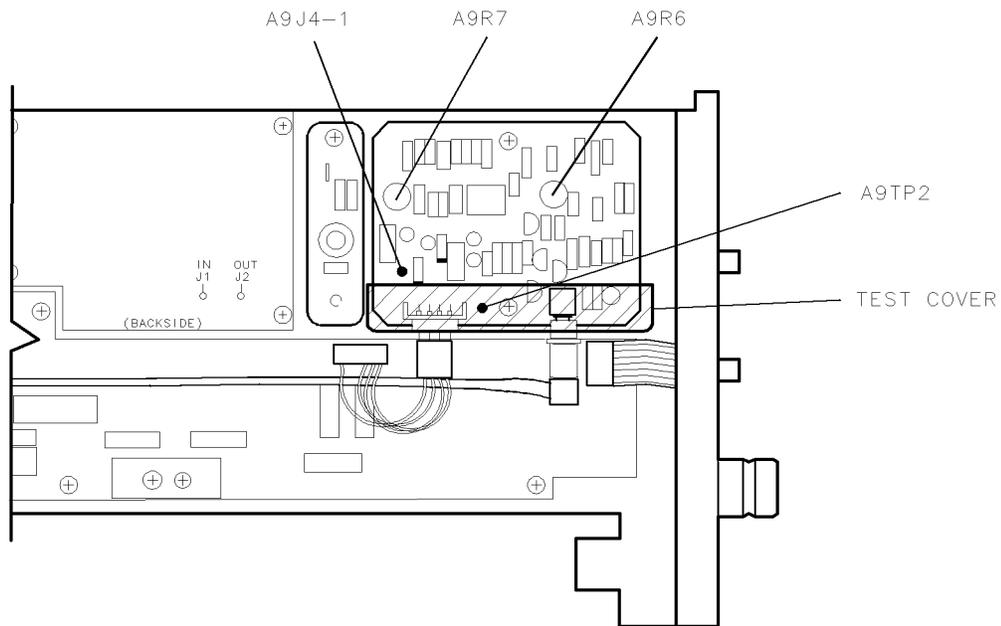
- Adjustment 03.01 VCO Tune-Line Voltage through Adjustment 03.13 Mixer Bias verify the operation of the A5, A7, A8, A9 second converter. Module verification software adjustments must be run consecutively.
- When you remove the cover of the 2nd converter to make an adjustment, replace it with a 2nd converter test cover (HP 5022-1150) to assure consistent ground connection and proper converter alignment.
- Prior to running any adjustments from the Adjustment 03. 2nd Converter Adjustments Menu, run the HP 8566B Spectrum Analyzer Calibration routine located under the Test Equipment Calibration Menu.

Adjustment 03.01 VCO Tune-Line Voltage



SCB12

Figure 5-10. Equipment Setup for Adjustment 03.01 VCO Tune-Line Voltage



epa4\_21p

Figure 5-11. Locations for Adjustment 03.01 VCO Tune-Line Voltage

**Adjustment 03.01 VCO Tune-Line Voltage****Test Equipment****Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	.2nd converter test cover
Extender module .....	HP 70001-60013 extender module

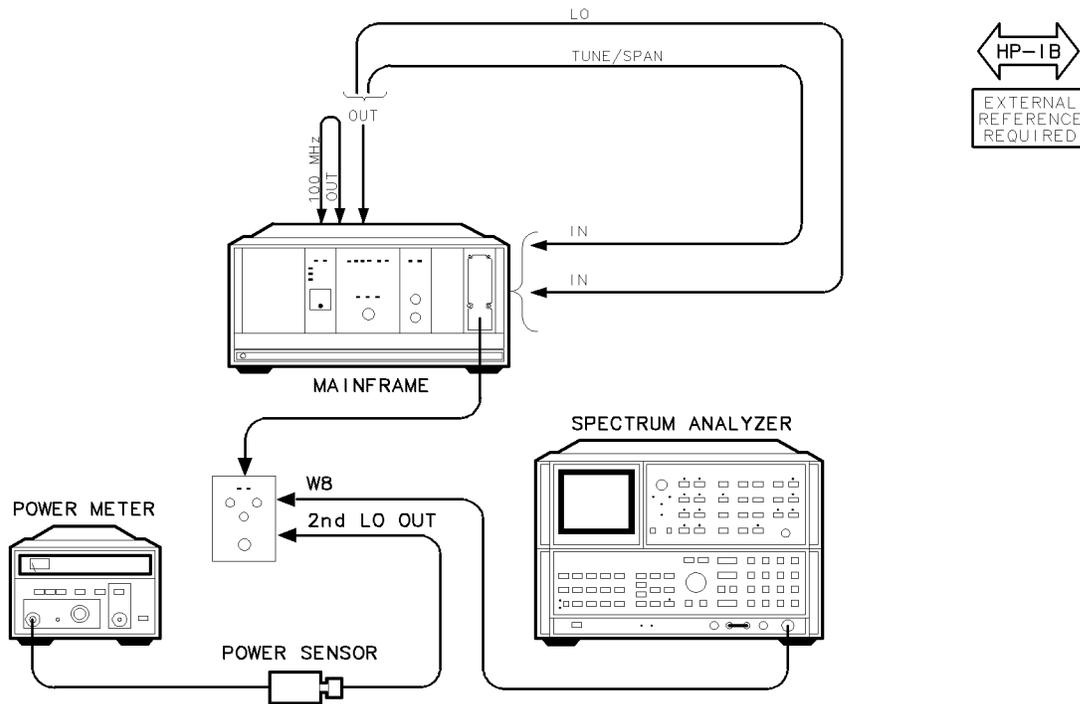
The purpose of this adjustment procedure is to adjust the VCO tune line voltage. It sets the open loop, varactor-diode bias to a known level, thus allowing other second LO adjustments.

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-10.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.01 VCO Tune-Line Voltage. (Refer to Chapter 3 for information about running module verification software.)

**Adjusting the VCO tune line voltage**

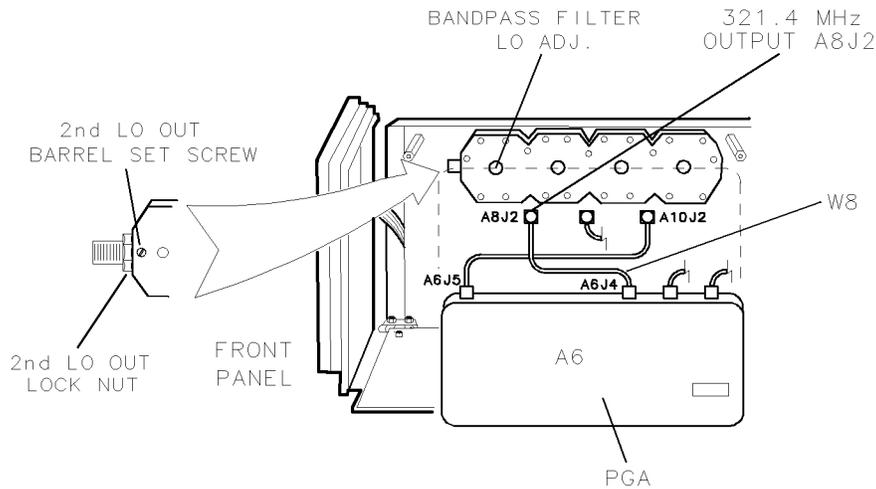
1. Connect the DVM to A9J4-1, VCO tune line. (The DVM 100 V range provides lower input resistance, which quickly drains probe cable capacitance.)
2. Adjust A9R6 fully clockwise.
3. Adjust A9R7 for a value between  $-4.504$  V and  $-5.496$  V.

Adjustment 03.02 VCO Frequency and Amplitude



scb13

Figure 5-12. Equipment Setup for Adjustment 03.02 VCO Frequency and Amplitude



epa4\_23p

Figure 5-13. Locations for Adjustment 03.02 VCO Frequency and Amplitude

**Adjustment 03.02 VCO Frequency and Amplitude**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Synthesized source .....	HP 8662A synthesized signal generator
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter (2 required) .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to provide an initial adjustment of the 3.3 GHz VCO 2nd LO frequency and amplitude while the VCO tune line voltage is set at its mid-range.

The VCO 2nd LO output amplitude is set with a power meter because of the VCO output match.

---

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.01 VCO Tune-Line Voltage.

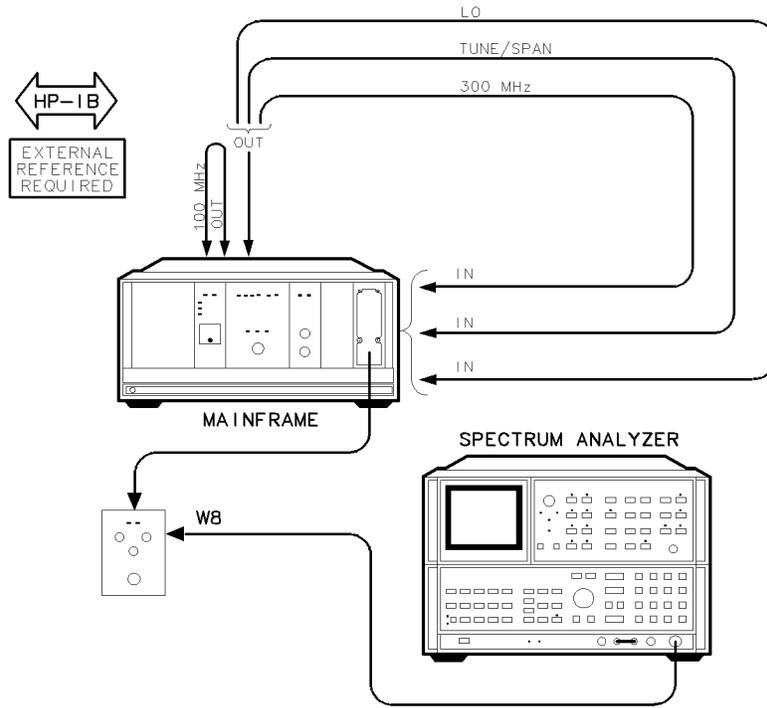
---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-12.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.02 VCO Frequency and Amplitude. (Refer to Chapter 3 for information about running module verification software.)

**Adjusting the VCO 2nd LO**

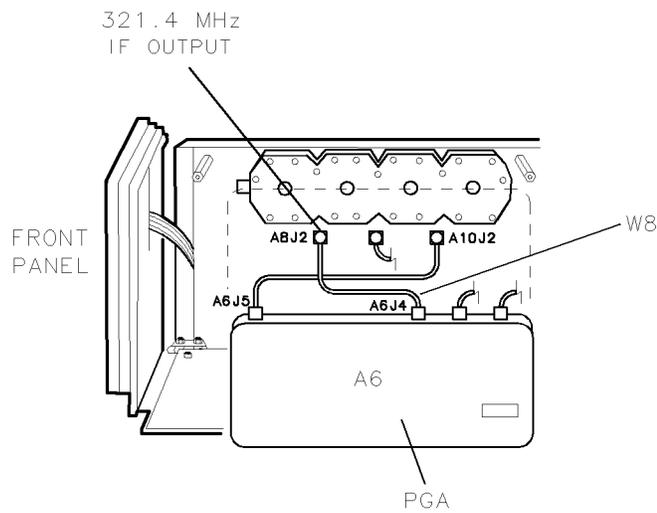
1. Disconnect W8 from A6J4 and connect it to the calibrated spectrum analyzer.
2. Connect the 2nd LO output port of the VCO cavity to the power meter through the power sensor.
3. Loosen the VCO 2nd LO cavity screw lock nut.
4. Using the 2nd Converter adjustment tool, adjust the VCO cavity tuning screw (LO ADJ) for a frequency on the calibrated spectrum analyzer between 3301 MHz and 3299 MHz.
5. Using the 2nd Converter adjustment tool, tighten the VCO 2nd LO cavity screw lock nut.
6. Loosen the 2nd LO OUT cavity SMA connector lock nut and lock screw.
7. Adjust the 2nd LO OUT cavity SMA connector in or out for an amplitude on the power meter between  $-7.0$  and  $-8.5$  dBm.
8. Tighten the 2nd LO OUT cavity SMA connector lock nut and lock screw.

Adjustment 03.03 2nd Converter LO Feedthrough



scb14

Figure 5-14. Equipment Setup for Adjustment 03.03 2nd Converter LO Feedthrough



epa4\_25p

Figure 5-15. Locations for Adjustment 03.03 2nd Converter LO Feedthrough

**Adjustment 03.03 2nd Converter LO Feedthrough****Test Equipment****Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the 3.3 GHz 2nd LO feedthrough from the 321.4 MHz IF output of the 2nd converter. Excessive feedthrough at this connector will normally indicate a faulty capacitor in the mixer bias network.

**Note**

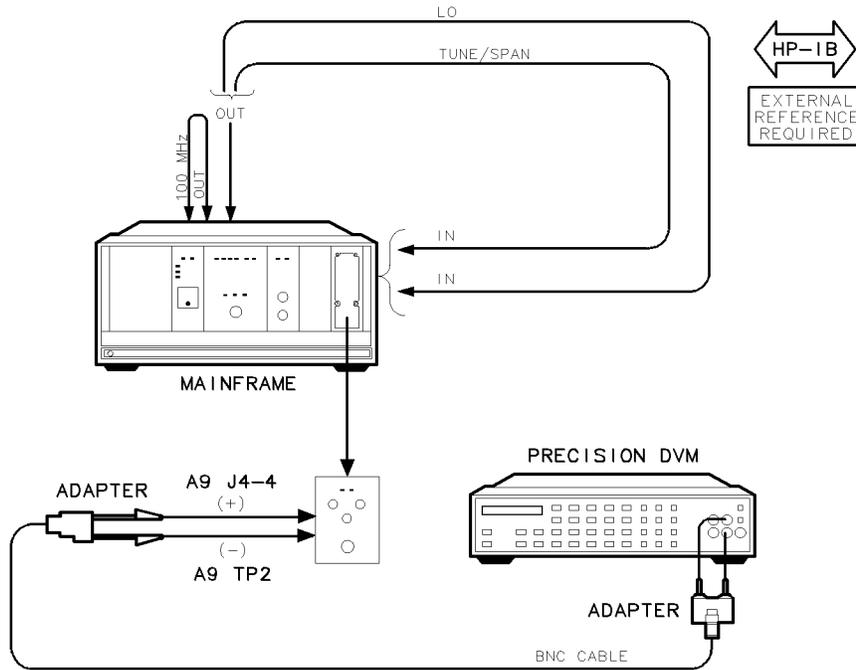
Before performing this measurement, verify completion of the following:

Adjustment 02. 1st LO Power  
Adjustment 03.02 VCO Frequency and Amplitude

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-14.
7. Disconnect W8 from A6J4 and connect it to the calibrated spectrum analyzer.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.03 2nd Converter LO Feedthrough. (Refer to Chapter 3 for information about running module verification software.)

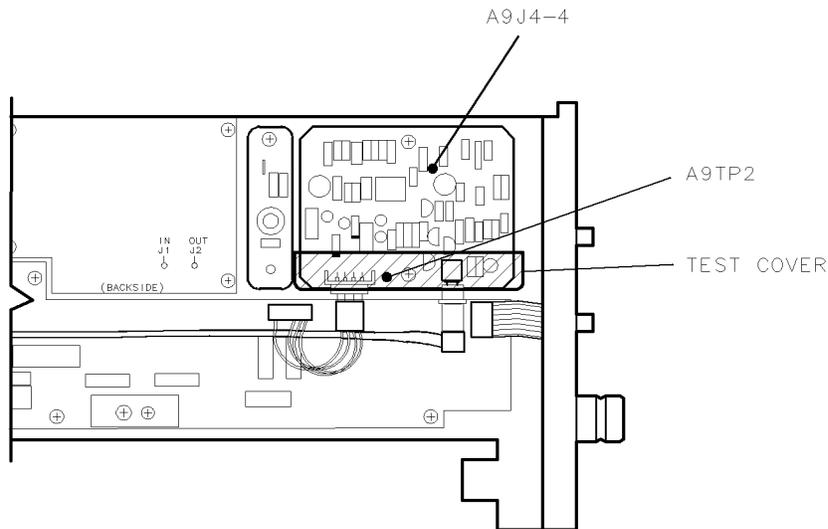
The HP 70900A/B local oscillator source provides the 300 MHz reference. The calibrated spectrum analyzer setup is 3.3 GHz center frequency, 10 MHz span. The spectrum analyzer measures 2nd LO feedthrough power which can range between limits of –29.0 dBm and –65.0 dBm.

Adjustment 03.04 Sampler DC IF Out



SCB15

Figure 5-16. Equipment Setup for Adjustment 03.04 Sampler DC IF Out



epa4\_27p

Figure 5-17. Locations for Adjustment 03.04 Sampler DC IF Out

**Adjustment 03.04 Sampler DC IF Out**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment is to measure the dc IF output voltage of the VCO sampler.

---

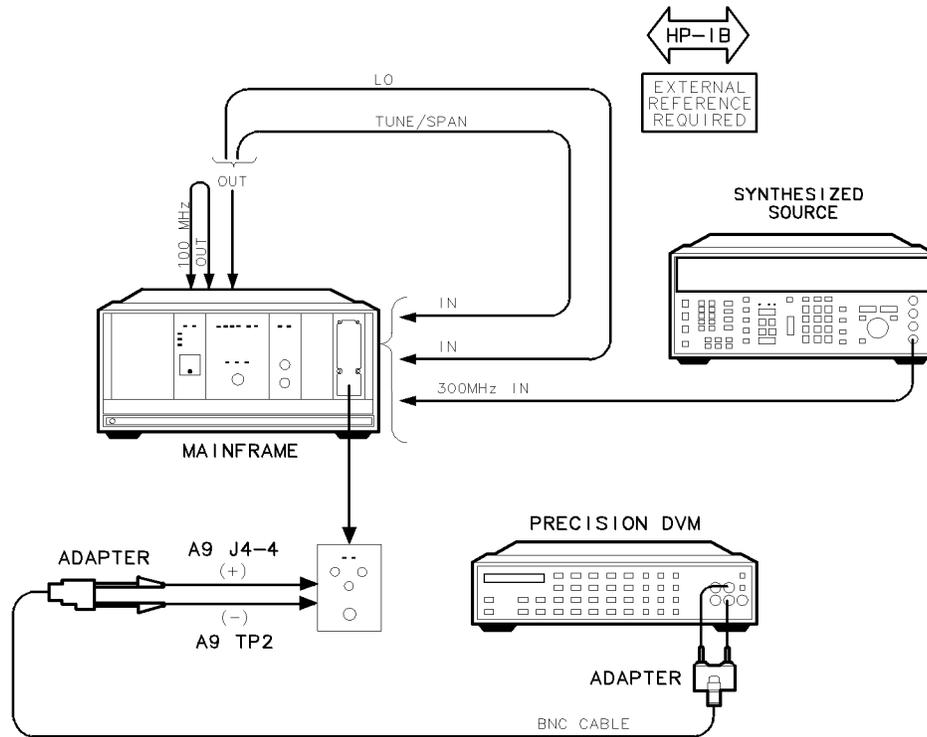
**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.02 VCO Frequency and Amplitude.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-16.
7. Connect the DVM to the sampler IF output at A9J4-4.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.04 Sampler DC IF Out. (Refer to Chapter 3 for information about running module verification software.)

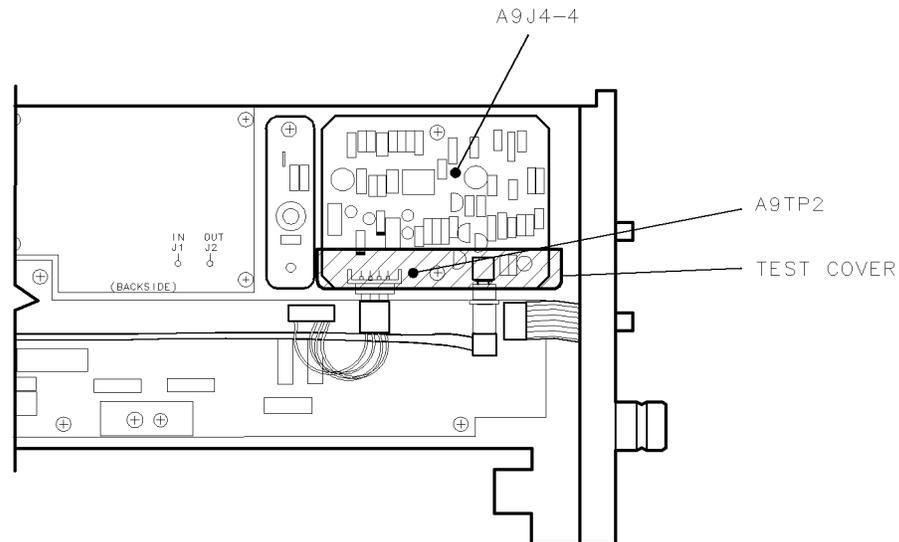
The synthesized signal generator provides 300 MHz at the DUT 300 MHz IN. The DVM 100 V range provides lower input resistance, which allows probe cable capacitance to quickly drain. The DVM verifies a A9J4-4 value between  $-0.0995$  V and  $+0.0995$  V.

Adjustment 03.05 Sampler AC IF Out



scb15b

Figure 5-18. Equipment Setup for Adjustment 03.05 Sampler AC IF Out



epa4\_29p

Figure 5-19. Locations for Adjustment 03.05 Sampler AC IF Out

**Adjustment 03.05 Sampler AC IF Out**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the ac voltage at the VCO sampler IF output.

---

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.02 VCO Frequency and Amplitude.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-18.
  - a. Connect the synthesized signal generator to the DUT 300 MHz IN.
  - b. Connect the DVM to the sampler IF output at A9J4-4.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.05 Sampler AC IF Out. (Refer to Chapter 3 for information about running module verification software.)

Initially the synthesized signal generator provides 299.9 MHz, 0 dBm, and then searches in 0.001 MHz and 0.0001 MHz steps between 299.9 MHz and 300.1 MHz. A routine verifies that the maximum peak-to-peak voltage as indicated by the DVM is between 0.07 Vrms and 0.124 Vrms.

Adjustment 03.06 Search Oscillator Duty Cycle and Period

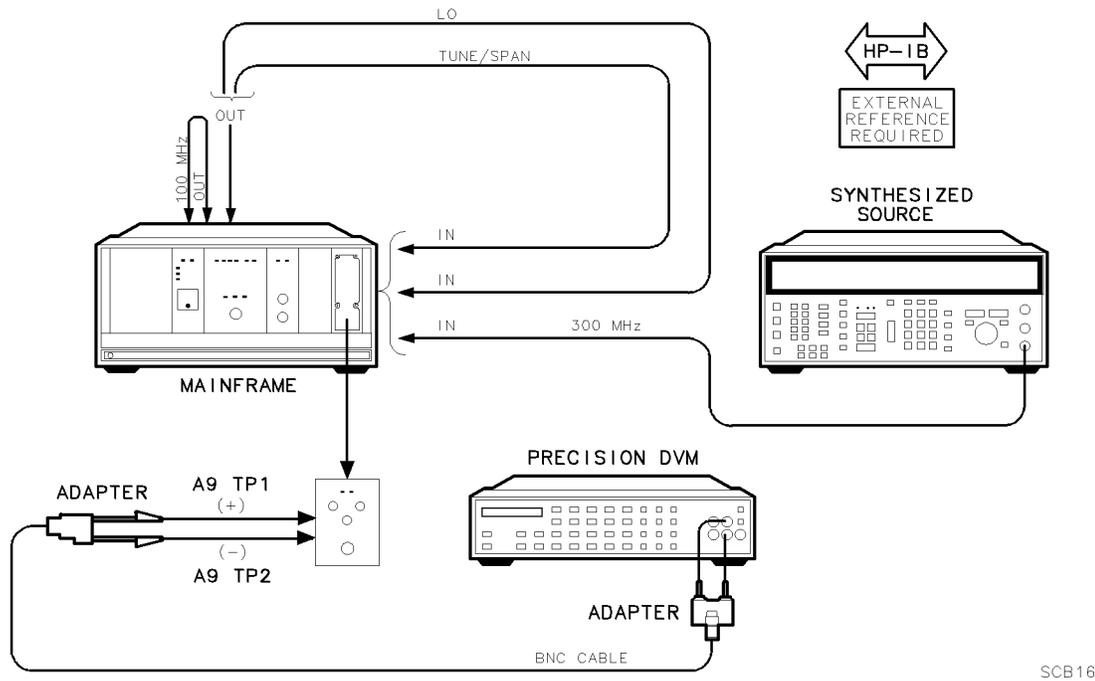


Figure 5-20. Equipment Setup for Adjustment 03.06 Search Oscillator Duty Cycle and Period

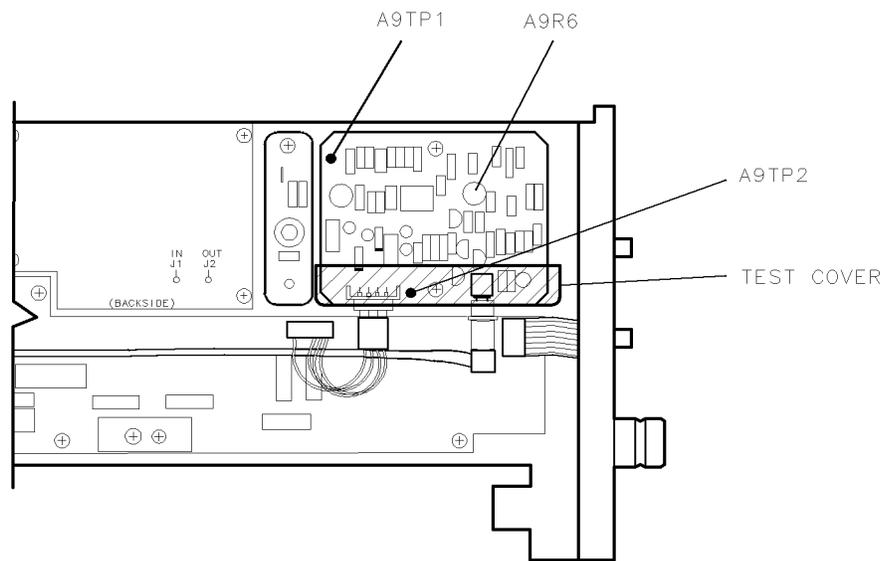


Figure 5-21. Locations for Adjustment 03.06 Search Oscillator Duty Cycle and Period

**Adjustment 03.06 Search Oscillator Duty Cycle and Period**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this procedure is to adjust the search oscillator square wave duty cycle and period of the 2nd converter.

---

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.01 VCO Tune-Line Voltage.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-20.
7. Connect the DVM to the PLL amplifier output at A9TP1.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.06 Search Oscillator Duty Cycle and Period. (Refer to Chapter 3 for information about running module verification software.)

The synthesized signal generator provides 302 MHz, 0 dBm, at the 300 MHz IN which causes the PLL to start searching.

Adjust duty cycle by means of A9R6 on the A2 RF first converter. A routine compares test limits to square-wave period and duty cycle. The test repeats with the synthesized signal generator providing 298 MHz.

Adjustment 03.07 Search Oscillator Square Wave Min/Max

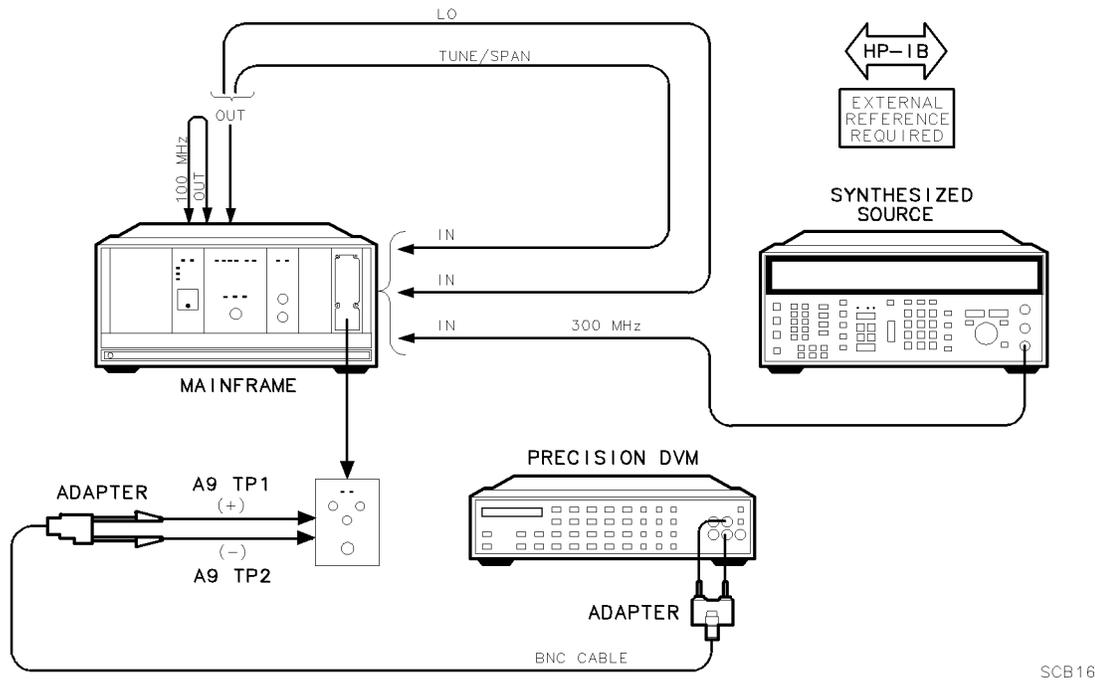


Figure 5-22. Equipment Setup for Adjustment 03.07 Search Oscillator Square Wave Min/Max

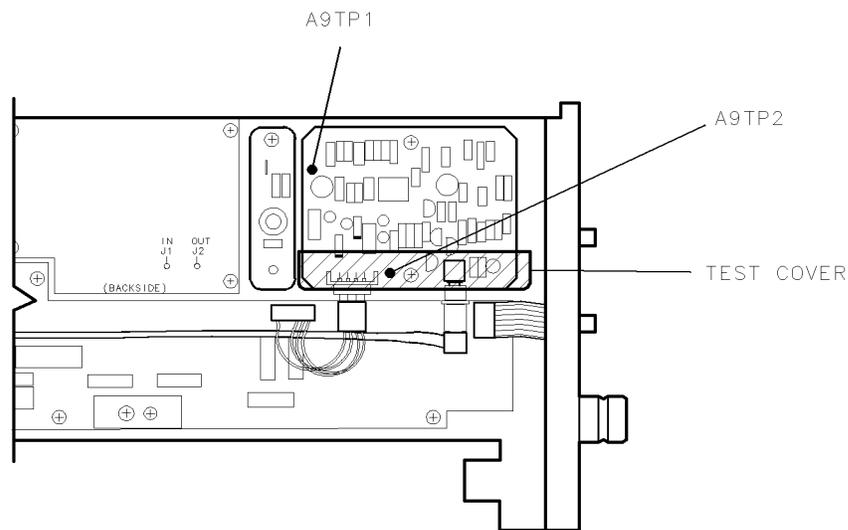


Figure 5-23. Locations for Adjustment 03.07 Search Oscillator Square Wave Min/Max

**Adjustment 03.07 Search Oscillator Square Wave Min/Max**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter .....	HP 1250-0671 50Ω SMB(m) to N(m)
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment is to check the search oscillator square wave minimum and maximum of the 2nd converter.

---

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.06 Search Oscillator Duty Cycle and Period.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-22.
7. Connect the DVM to the PLL amplifier output at A9TP1.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.07 Search Oscillator Square Wave Min/Max. (Refer to Chapter 3 for information about running module verification software.)

The synthesized signal generator provides 302 MHz, 0 dBm, at the 300 MHz IN. The test makes multiple DVM measurements. A routine then verifies minimums between  $-9.5$  V and  $-12.6$  V and maximums between  $+9.5$  V and  $+12.6$  V. The test repeats with the synthesized signal generator providing 298 MHz.

Adjustment 03.08 Search Oscillator VCO Tune Line

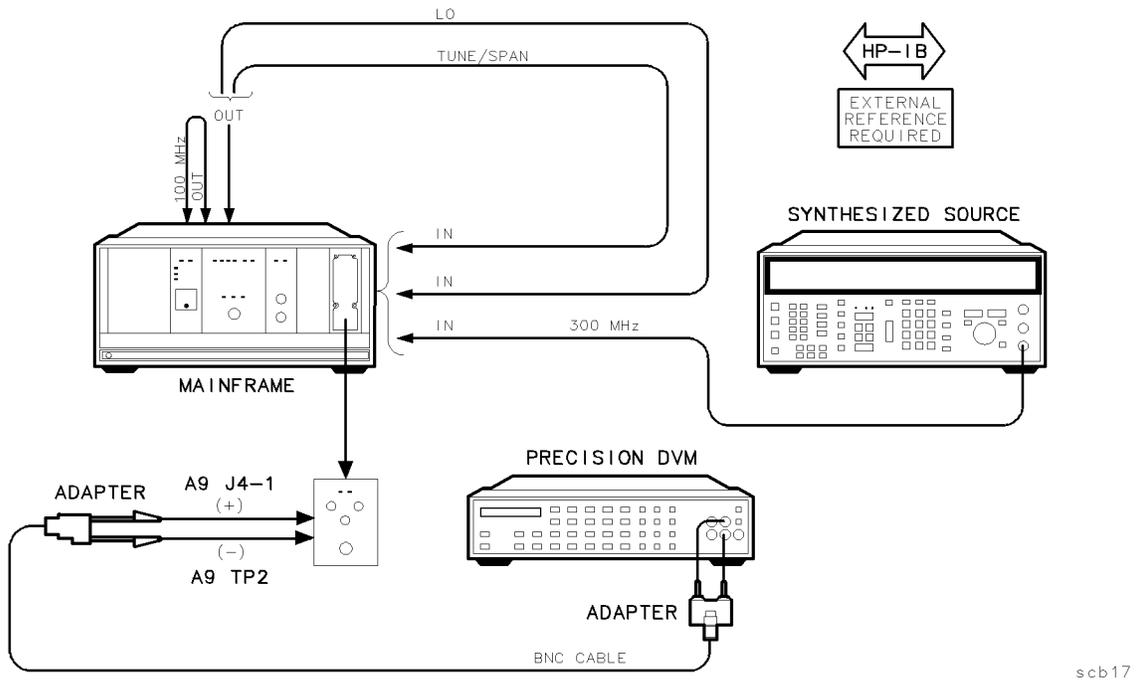


Figure 5-24. Equipment Setup for Adjustment 03.08 Search Oscillator VCO Tune Line

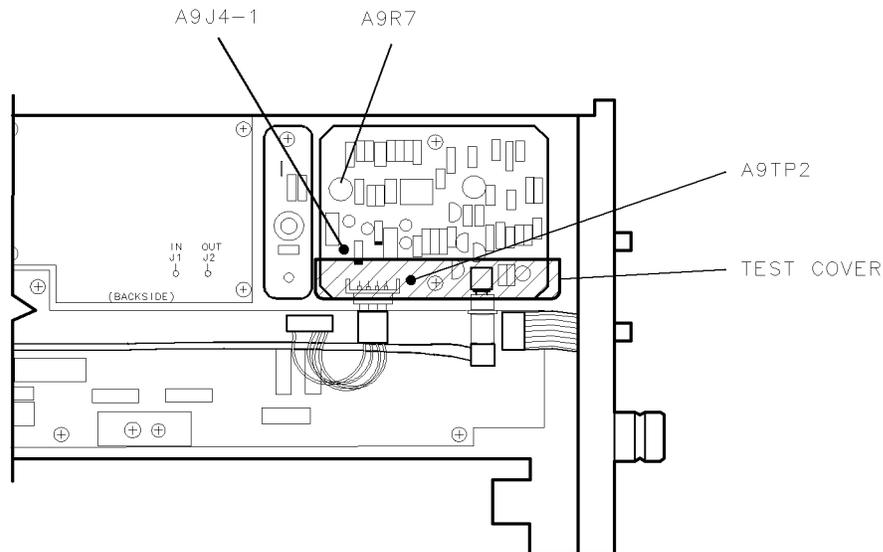


Figure 5-25. Locations for Adjustment 03.08 Search Oscillator VCO Tune Line

**Adjustment 03.08 Search Oscillator VCO Tune Line**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this procedure is to adjust the search oscillator for a peak on the VCO tune line of the 2nd converter.

---

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.06 Search Oscillator Duty Cycle and Period.

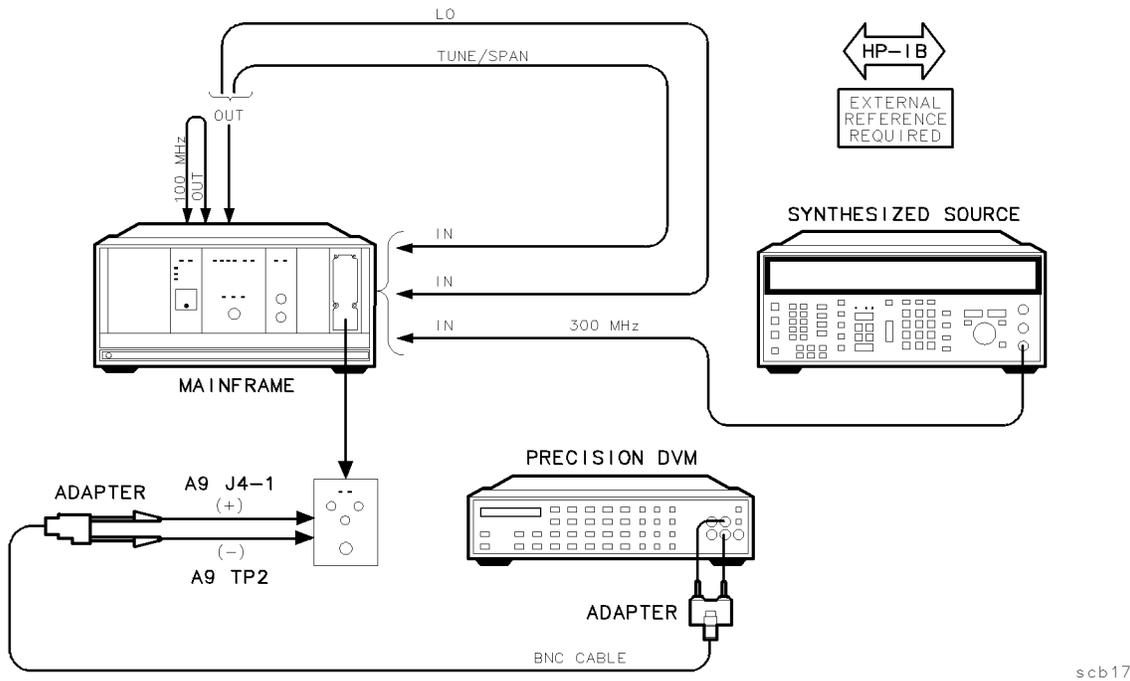
---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-24.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.08 Search Oscillator VCO Tune Line. (Refer to Chapter 3 for information about running module verification software.)

**Adjusting the search oscillator**

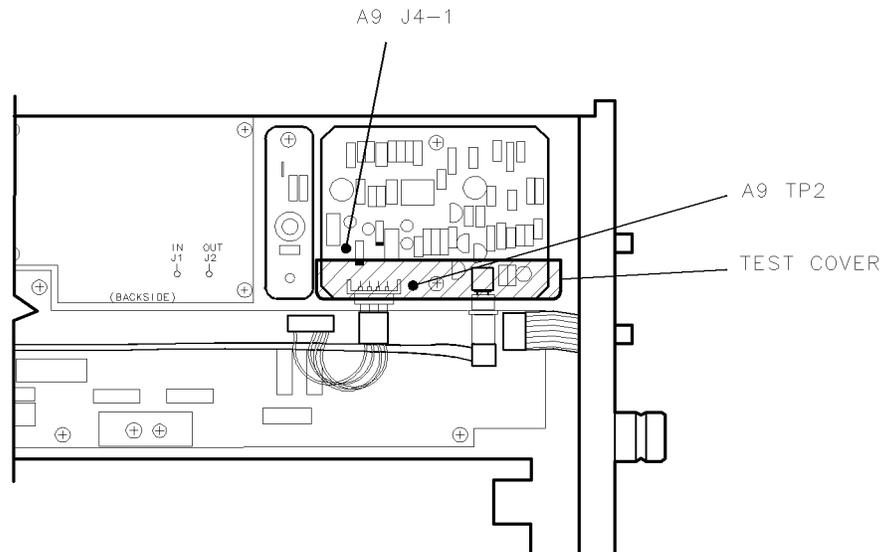
1. Connect the DVM to A9J4-1, VCO tune line.
2. Adjust A9R7 while watching for a centered pointer on the controller display.

Adjustment 03.09 Phase Lock



scb17

Figure 5-26. Equipment Setup for Adjustment 03.09 Phase Lock



epa4\_37p

Figure 5-27. Locations for Adjustment 03.09 Phase Lock

**Adjustment 03.09 Phase Lock**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to check the 2nd converter phase lock.

---

**Note** Before performing this adjustment, verify completion of the following:

Adjustment 03.06 Search Oscillator Duty Cycle and Period  
Adjustment 03.07 Search Oscillator Square Wave Min/Max  
Adjustment 03.08 Search Oscillator VCO Tune Line

---

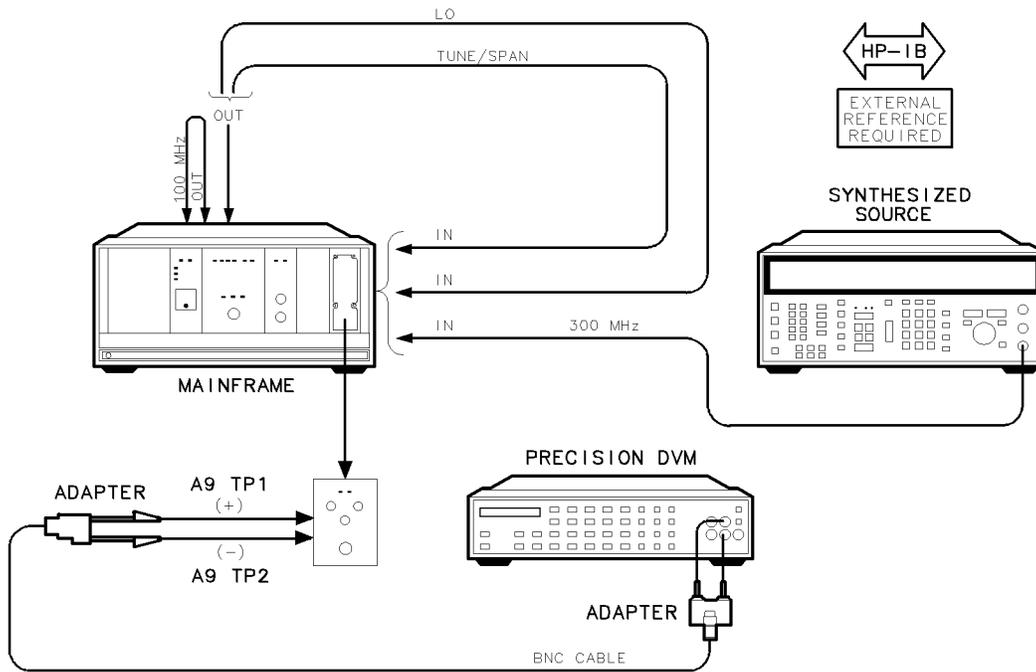
1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-26.
7. Connect the DVM to A9J4-1, VCO Tune Line.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.09 Phase Lock. (Refer to Chapter 3 for information about running module verification software.)

The procedure checks the RF section for phase lock of the 2nd converter PLL.

An unlock condition causes a fail message.

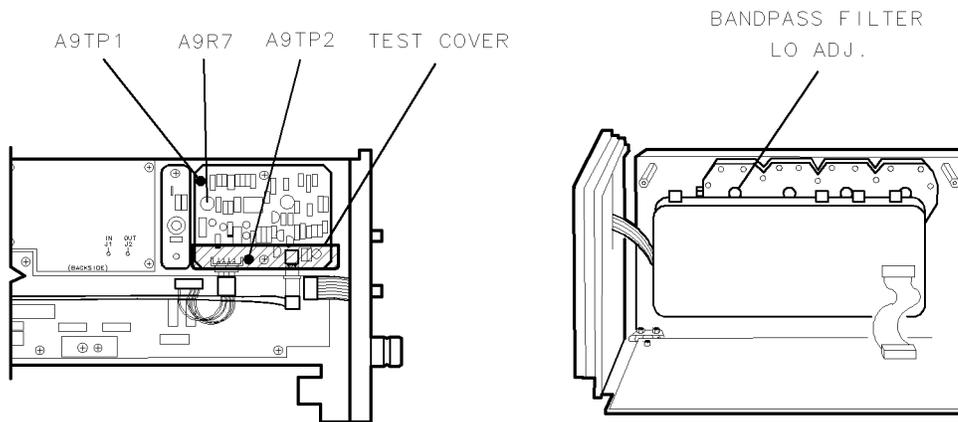
A locked condition results in a comparison of test limits and a DVM measurement of the VCO tune line.

Adjustment 03.10 VCO Tune Range



SCB16

Figure 5-28. Equipment Setup for Adjustment 03.10 VCO Tune Range



epa4\_39p

Figure 5-29. Locations for Adjustment 03.10 VCO Tune Range

**Adjustment 03.10 VCO Tune Range**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to center the 2nd converter VCO tune range.

---

<b>Note</b>	Before performing this adjustment, verify completion of the following: Adjustment 03.06 Search Oscillator Duty Cycle and Period Adjustment 03.07 Search Oscillator Square Wave Min/Max Adjustment 03.08 Search Oscillator VCO Tune Line
-------------	--

---

This part of the 2nd converter adjustment is performed twice:

- (1) after Adjustment 03.09 Phase Lock, and
- (2) as the last part of Adjustment 03.12 Bandpass Filter and VCO Tune Range Final.

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-28.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.10 VCO Tune Range. (Refer to Chapter 3 for information about running module verification software.)

**Adjusting VCO Tune Range**

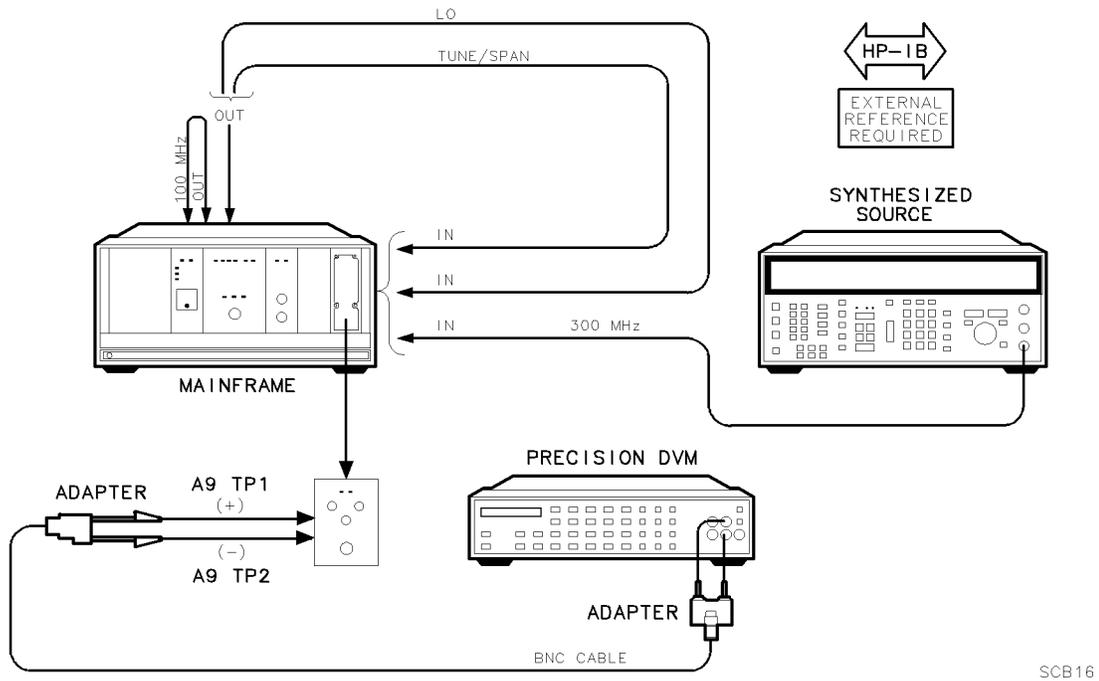
1. Connect the DVM to the A9TP1, the phase-lock-loop amplifier output.
2. Adjust the 2nd LO cavity screw for a value between  $-7.97$  V and  $7.53$  V as indicated on the DVM.

An unlock condition causes an UNLOCK warning on the controller display. (Typically a very slight CCW rotation of the LO ADJ cavity screw will lock up the VCO.) The test compares two DVM measurements, and displays a SEARCHING message if the results are too far apart.

The synthesized signal generator frequency is set to 299.35 MHz.

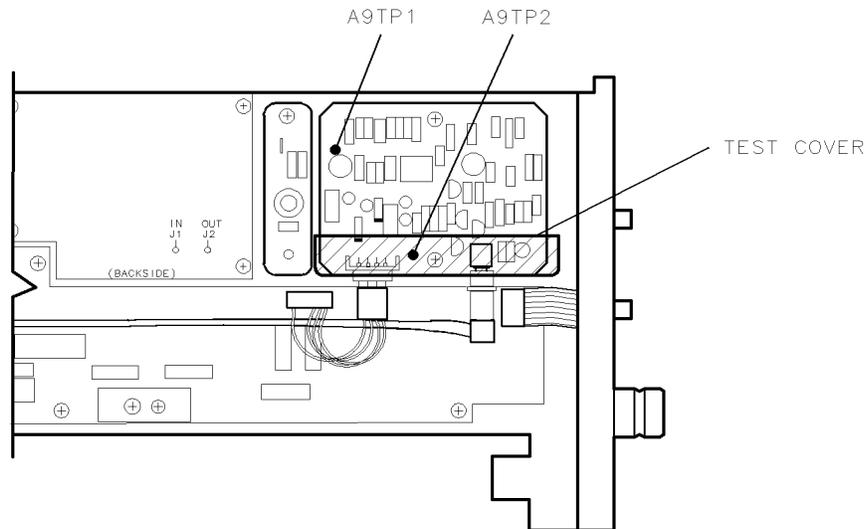
3. Adjust the A9R7 for a DVM reading between  $+7.53$  V and  $+7.97$  V. An unlock condition or measurements too far apart cause the respective message on the controller display.
4. Repeat the adjustment until the VCO tune range is within test limits.

## Adjustment 03.11 Lock Range Measurement



SCB16

Figure 5-30. Equipment Setup for Adjustment 03.11 Lock Range Measurement



epa4\_41p

Figure 5-31. Locations for Adjustment 03.11 Lock Range Measurement

## Adjustment 03.11 Lock Range Measurement

Test Equipment	Preferred Model Numbers
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to check the lock range of the 2nd converter.

---

**Note** Before performing this adjustment, verify completion of the following:

Adjustment 03.06 Search Oscillator Duty Cycle and Period  
 Adjustment 03.07 Search Oscillator Square Wave Min/Max  
 Adjustment 03.08 Search Oscillator VCO Tune Line

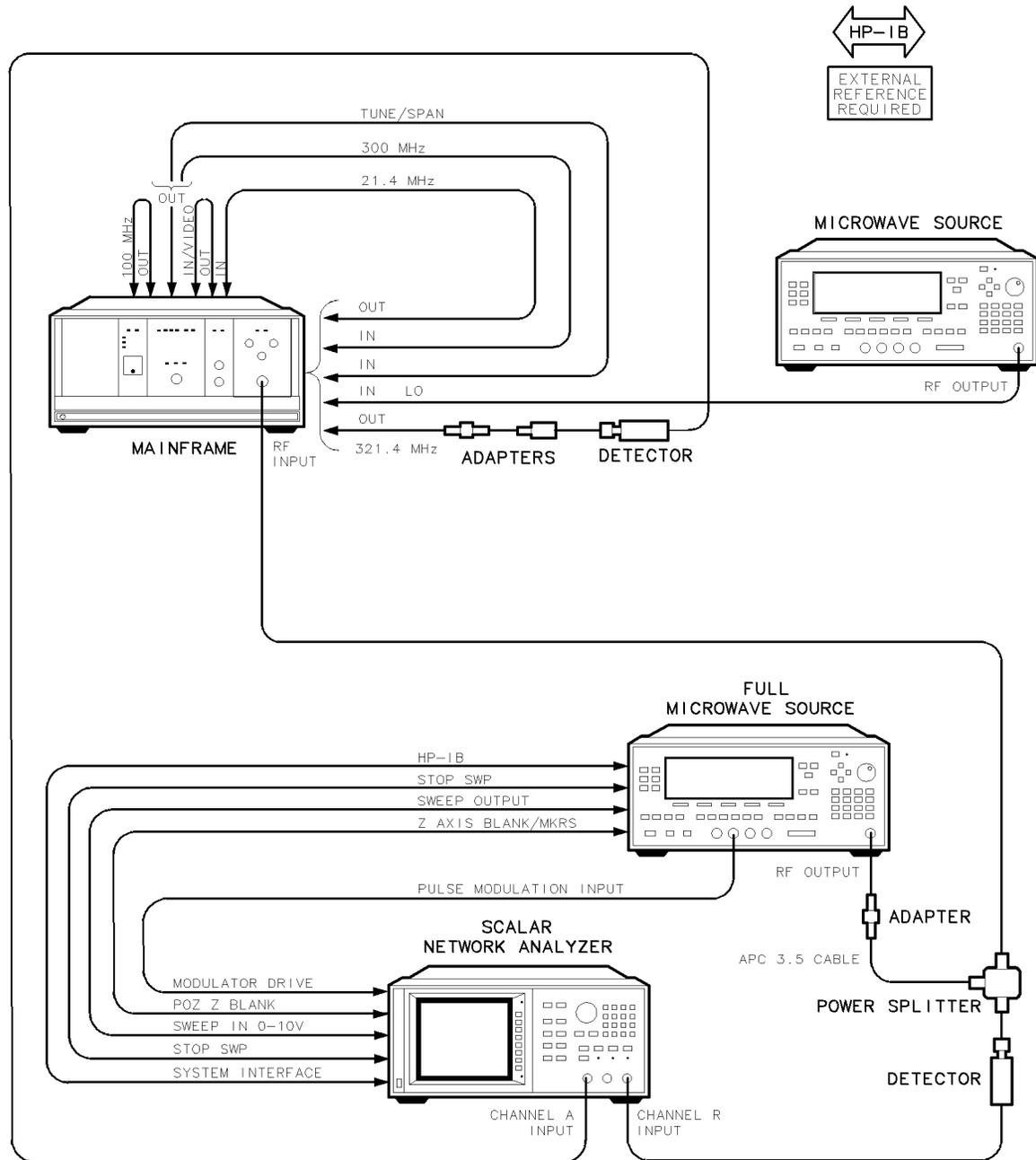
---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-30.
7. Connect the DVM to the A9TP1, 2nd converter PLL amplifier output.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.11 Lock Range Measurement. (Refer to Chapter 3 for information about running module verification software.)

The synthesized signal generator initially provides 299.35 MHz at the DUT 300 MHz IN. The signal generator frequency decrements in 0.01 MHz steps until the PLL unlocks; the frequency then increments in 0.01 MHz steps until the PLL locks. The test compares the lock frequency with the test limit. If the lower lock frequency meets the test limit, a routine stores the associated DVM measurement.

To determine the upper lock frequency and voltage, the test repeats with a synthesized signal generator set to 300.6 MHz.

## Adjustment 03.12 Bandpass Filter and VCO Tune Range Final



bpfvco

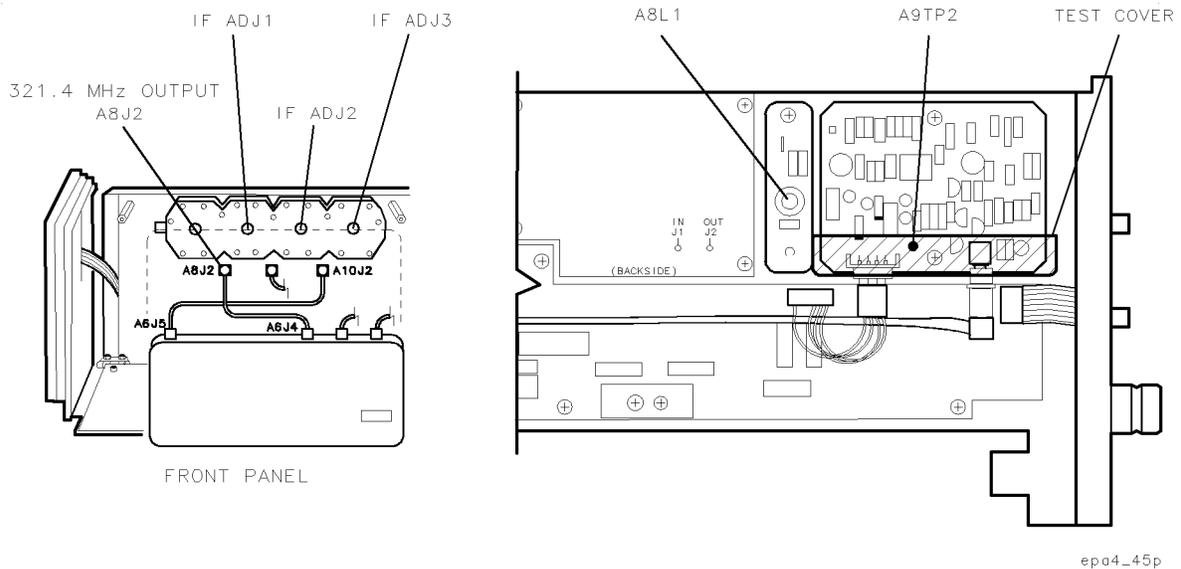
**Figure 5-32.**  
**Equipment Setup for Adjustment 03.12 Bandpass Filter and VCO Tune Range Final**

**Adjustment 03.12 Bandpass Filter and VCO Tune Range Final**

**Test Equipment**

**Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Synthesized source .....	HP 8662A synthesized signal generator
Full microwave source (2 required) ...	HP 83630A/B Option 001 and 008 synthesized sweeper
Network analyzer .....	HP 8757D scalar network analyzer
Detector (2 required) .....	HP 85025B detector
Isolator .....	HP 0955-0204 microwave isolator
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (5 required) .....	HP 10503A 122 cm 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module



**Figure 5-33. Locations for Bandpass Filter Tune Range and VCO Tune Range**

The purpose of this adjustment procedure is: (1) to align the 2nd converter 3621.4 MHz bandpass filter shape, and (2) to perform the final adjustment of VCO tune range.

**Note** Before performing this adjustment, verify completion of the following:  
Adjustment 03.11 Lock Range Measurement.

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.

**Adjustment 03.12 Bandpass Filter and VCO Tune Range Final**

3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-32.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 03.12 Bandpass Filter and VCO Tune Range Final. (Refer to Chapter 3 for information about running module verification software.)

The synthesized signal generator provides 300 MHz, 0 dBm, at the DUT INPUT. The full microwave source provides 3921.4 MHz, 8 dBm, at the DUT LO input. The network analyzer channel-A detector connects to the DUT 321.4 MHz OUT.

**Adjusting the bandpass filter**

Adjust the three 2nd converter bandpass-filter tuning screws and the matching inductor on the A8 321.4 MHz matching assembly while you view the network analyzer response. The adjusted parameters are: maximum amplitude, flatness, 3 dB bandwidth, and 42.8 MHz image rejection.

The response must satisfy the following limits:

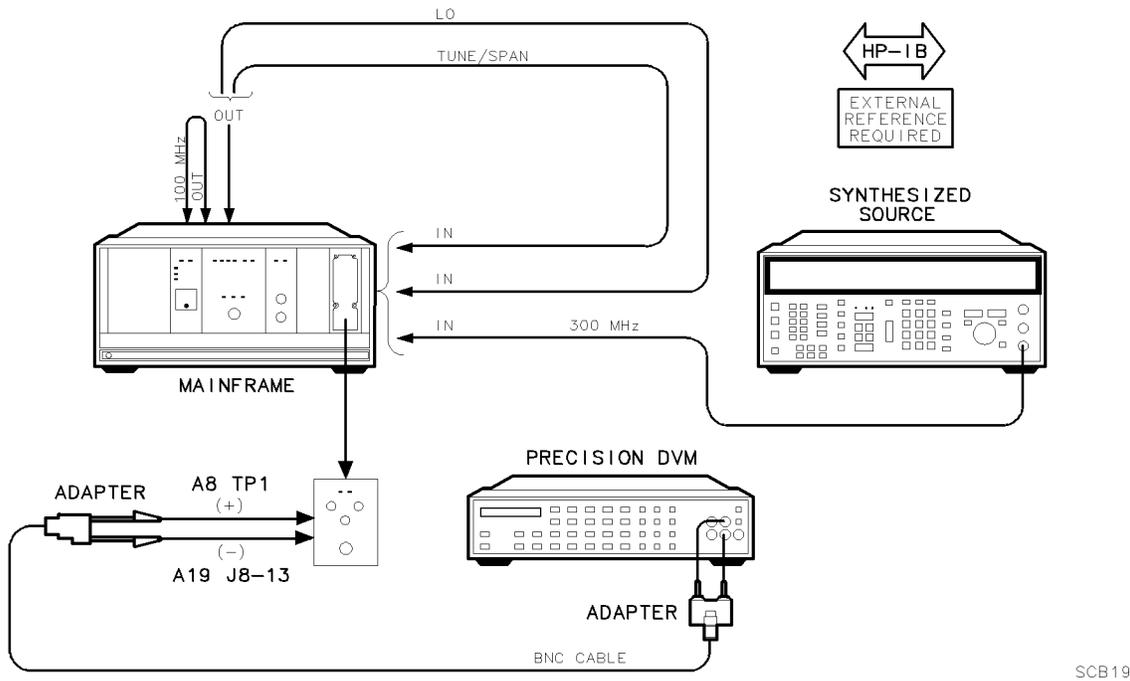
- amplitude,  $-19$  to  $-14$  dBm
- flatness,  $-0.5$  to  $0.2$  dB relative to amplitude at 3621.4 MHz, 15 MHz on either side of center (a slight adjustment of the 2nd converter bandpass filter input coupling connector is acceptable to improve flatness)
- 3 dB bandwidth, 52 to 56 MHz
- image rejection, equal to or greater than 23 dB relative to the 3621.4 MHz center frequency.

---

**Note** Adjustment of the bandpass filter can affect the VCO tune range; therefore, Adjustment 03.10 VCO Tune Range must be run again after any adjustment of the bandpass filter.

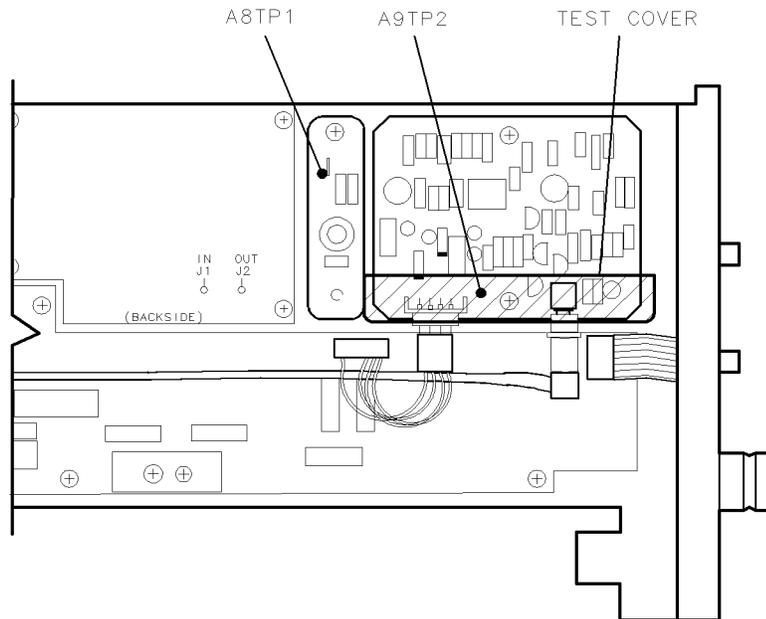
---

Adjustment 03.13 Mixer Bias



SCB19

Figure 5-34. Equipment Setup for Adjustment 03.13 Mixer Bias



epa4\_43p

Figure 5-35. Locations for Adjustment 03.13 Mixer Bias

**Adjustment 03.13 Mixer Bias**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover .....	2nd converter test cover
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the mixer bias of the 2nd converter.

---

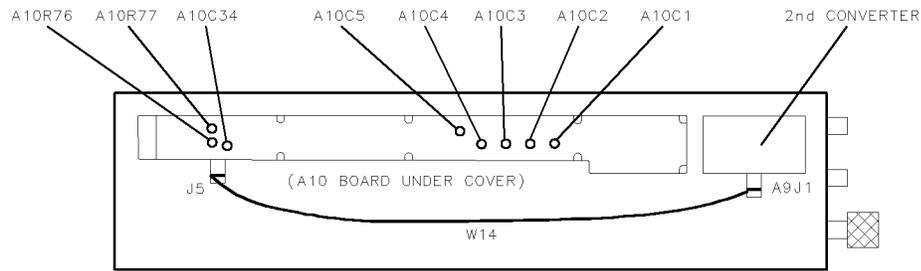
**Note** Before performing this adjustment, verify completion of all of the 2nd converter adjustments.

---

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-34.
7. Connect the DVM to A8TP1.
8. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
9. Load and run Adjustment 03.13 Mixer Bias. (Refer to Chapter 3 for information about running module verification software.)
10. Replace the 2nd converter cover after this adjustment.

The synthesized signal generator provides 300 MHz at the DUT 300 MHz IN. (The DVM 100 V range provides lower input resistance, which allows probe cable capacitance to quickly drain.) The test verifies a DVM measurement between 0.604 V and 1.296 V.



**Adjustment 04. Last Converter Alignment**

c1d1\_d

**Figure 5-37. Locations for Adjustment 04. Last Converter Alignment****Test Equipment****Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Full microwave source (2 required) ...	HP 83630A/B Option 001 and 008 synthesized sweeper
Network analyzer .....	HP 8757D scalar network analyzer
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Detector (2 required) .....	HP 85025B detector
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (5 required) .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Extender module .....	HP 70001-60013 extender module

The purpose of this procedure, which consists of five parts, is to adjust the last converter.

1. Adjustment of the 300 MHz bandpass filter (to 2nd Converter)
2. Adjustment of the 278.6 MHz notch filter
3. Adjustment of the 321.4 MHz bandpass filter
4. Adjustment of the gain of the 321.4 MHz to 21.4 MHz down conversion path
5. Adjustment that sets the amount of gain supplied by the step gain section

**Adjustment 04. Last Converter Alignment**

A number of module and system specifications are affected by these adjustments. Some of the performance parameters affected are:

- Gain
- Noise figure/D.A.N.L.
- TOI
- 21.4 MHz response
- IF rejection
- Image rejection
- IF subharmonics
- 10.7 MHz response
- IF beats
- Step gain accuracy

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-36.

---

**Note**            The last converter cover must be installed.

---

7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 04. Last Converter Alignment. (Refer to Chapter 3 for information about running module verification software.)

The gain of the programmable gain amplifier and the last converter from the EXT Mixer 321.4 MHz IF input to the 321.4 MHz output is measured. The network analyzer 'A' detector is connected to the 321.4 MHz out on the DUT.

- If the gain is not within 23.0 dB  $\pm$ 4 dB, you are referred to the troubleshooting mode to help locate the problem.
- If the gain is within the setup check, the network analyzer source output power is set to 0 dB minus the gain dB.

## Adjustment 04. Last Converter Alignment

### Adjusting the 300 MHz bandpass filter (to 2nd Converter)

1. Disconnect SMB cable W14 from the A10J5 (300 MHz OUT).
2. Connect A10J5 (300 MHz OUT) to the spectrum analyzer through an SMB to BNC cable. (Refer to “A10 Last Converter” in Chapter 8).
3. Adjust the A10C34 (300 MHz) for a maximum amplitude of 300 MHz as indicated on the calibrated spectrum analyzer.

### Presetting the 321.4 MHz bandpass filter capacitors

1. Connect the network analyzer channel A detector to the UUT's 21.4 MHz output.
2. Adjust the 321.4 MHz bandpass filter capacitors, A10C1, C2, C3, and C4, to approximately one-fourth capacitance and A10R77 (LO GAIN) to center.

### Adjusting the 300 MHz bandpass filter (to 2nd Converter)

1. Adjust A10C34 (300 MHz) for maximum response on the HP 8566B spectrum analyzer display.
2. Press **MKR -> REF LVL** on the HP 8566B spectrum analyzer; doing this sets the top graticule on the HP 8566B spectrum analyzer to the signal peak.
3. Readjust A10C34 (300 MHz) for maximum response on the network analyzer display.
4. Note the maximum signal level on the network analyzer display.
5. Readjust A10C34 (300 MHz) again, only this time iterate between the HP 8566B spectrum analyzer and the network analyzer displays until the HP 8566B spectrum analyzer's display is with 1 dB of the top graticule and the signal on the network analyzer display is within 0.2 dB of the maximum signal level noted in step 4 above.

### Adjusting the 278.6 MHz notch filter

1. Adjust A10C1, C2, C3, and C4 for a peak response at 278.6 MHz.

This detunes the 321.4 MHz bandpass filter *temporarily* in order to locate the 278.6 MHz notch.

2. Adjust A10C5 for a minimum.

---

**Note** Do not readjust A10C5 after this step.

---

### Coarse adjusting the 321.4 MHz bandpass shape

Readjust A10C1, C2, C3, and C4 for a bandpass response at 321.4 MHz on the network analyzer display.

### Fine adjusting the 321.4 MHz bandpass shape

Adjust A10C1, C2, C3, and C4 for a bandpass shape that is within the limit lines of the network analyzer display.

### Adjusting the gain for the down conversion path

1. Connect the power sensor to the UUT's 321.4 MHz output. The power level of the synthesizer adjusts so that the UUT's output is  $-6.0$  to  $-5.5$  dBm and the actual level is noted.
2. Connect the power sensor to the UUT's 21.4 MHz output using the same cables and adapters.

**Adjustment 04. Last Converter Alignment**

3. Adjust A10R77 (LO GAIN) until the power level is within .05 dB of the level noted at the 321.4 MHz output.

**Adjusting the step gain**

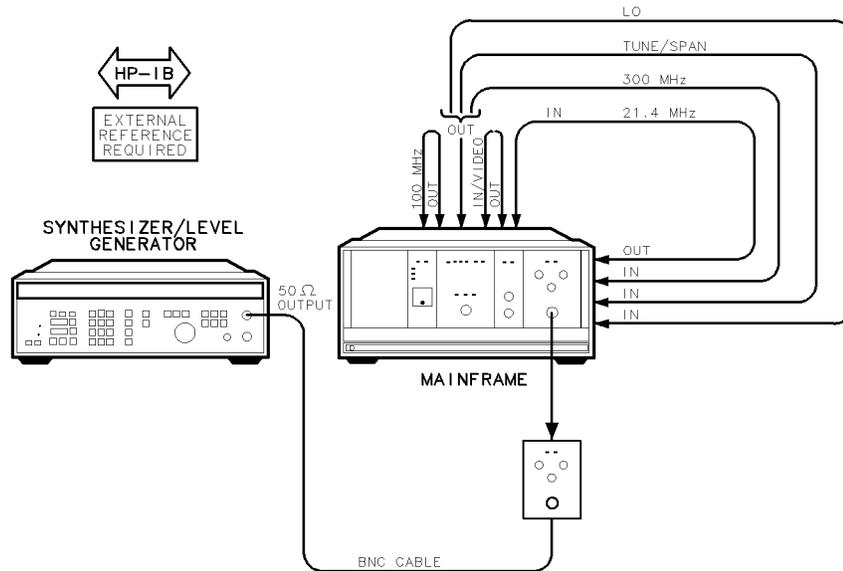
The microwave source power level is set so that the power level at the UUT's 21.4 MHz output is  $-16.0$  to  $-15.5$  dBm and the level is noted. The UUT's step gain is activated.

Adjust A10R76 (HI GAIN) until the 21.4 MHz output is  $10.0 \text{ dB} \pm .05 \text{ dB}$  greater than the noted power level.

After completing the adjustments, connect detector A of the network analyzer to the UUT's 21.4 MHz output. The test now measures the following parameters:

- passband flatness
- 3 dB bandwidth
- 278.6 MHz rejection
- amplitude and frequency of the 10.7 MHz notch filter

## Adjustment 05. PGA Calibration



scb1

Figure 5-38. Equipment Setup for Adjustment 05. PGA Calibration

### Test Equipment

### Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 3335A synthesizer/level generator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Extender module .....	HP 70001-60013 extender module

**Adjustment 05. PGA Calibration**

The purpose of this adjustment procedure is to calibrate the A6 programmable gain amplifier.

---

**Note** Before performing this adjustment, verify completion of the following:

- Adjustment 02. 1st LO Power
- All 2nd converter adjustments
- Adjustment 04. Last Converter Alignment

---

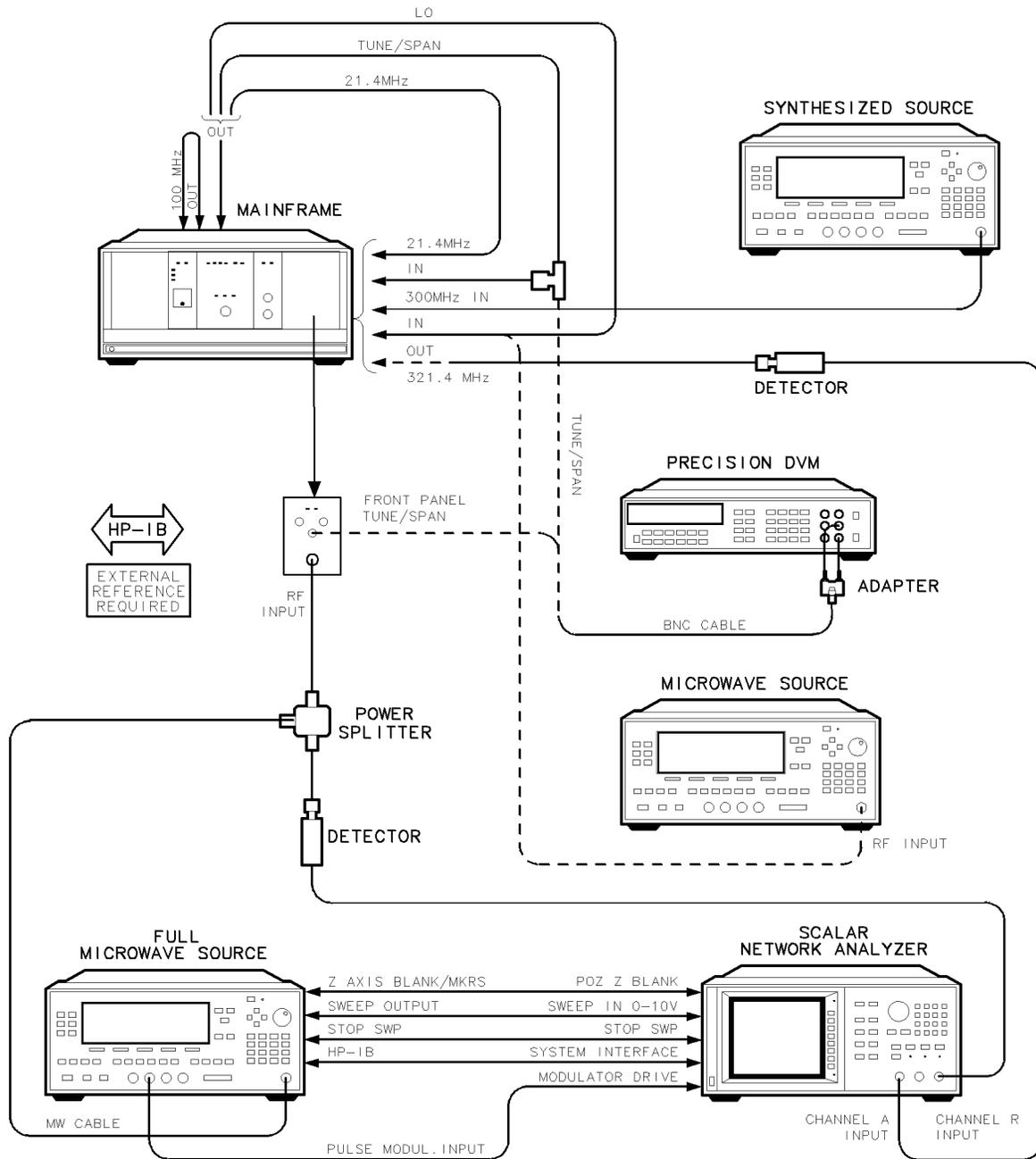
1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-38.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 05. PGA Calibration. (Refer to Chapter 3 for information about running module verification software.)

The synthesized source, RF, IF, and LO modules are set to reference levels. The 21.4 MHz output of the UUT is measured and compared against the minimum power setup limit.

The DAC number is decreased while the 21.4 MHz output power is monitored. When the output power decreases by .2 dB, the DAC number is held constant. The amplitude of the 21.4 MHz output is noted for use as a reference and the DAC number is noted and stored as the maximum gain setting for the PGA.

The adjustment procedure continues to increase the RF source amplitude in .1 dB steps, and determines the appropriate DAC number until the entire specified range of the programmable gain amplifier has been measured. All of the data is compared to test limits and stored in EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

## Adjustment 06. YTF Alignment



scb2b

Figure 5-39. Equipment Setup for Adjustment 06. YTF Alignment

## Adjustment 06. YTF Alignment

Test Equipment	Preferred Model Numbers
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Full microwave source (2 required) ...	HP 83630A/B Option 001 and 008 synthesized sweeper
Network analyzer .....	HP 8757D scalar network analyzer
Power splitter .....	HP 11667B power splitter
Detector (2 required) .....	HP 85025B detector
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required) .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter .....	HP 1250-1391 50Ω SMB tee(m) (f) (m)
Extender module .....	HP 70001-60013 extender module

The purpose of this adjustment procedure is to adjust the offset DAC, gain DAC, delay DAC, and breakpoint DAC to achieve optimum static and dynamic tracking of the YTF with the TUNE SPAN voltage from the HP 70900A/B local oscillator source.

This adjustment procedure is also used to perform a rough check of the slow sweep filter and to determine the Offset DAC value for the 1H– band that produces 0 volts at the RF section’s front panel EXT MIXER TUNE/SPAN output connector when the center frequency is tuned to 0 Hz. The optimum DAC voltages for each band are written into the EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

1. Set the mainframe line switch to OFF.
2. Remove the RF section from the mainframe.
3. Install the extender module in the mainframe and connect the RF section to the extender cable.
4. Remove the cover. (Refer to “Module Cover” in Chapter 8.)
5. Place the A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
6. Connect the equipment as shown in Figure 5-39.
7. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
8. Load and run Adjustment 06. YTF Alignment. (Refer to Chapter 3 for information about running module verification software.)

---

**Note** This adjustment will have you move the DVM connection from the front panel “TUNE/SPAN” output to the rear panel “TUNE/SPAN” input. Ensure you follow the directions carefully or you may cause a misadjustment or test failure.

---

## Adjustment 06. YTF Alignment

### Coarse adjusting the YTF

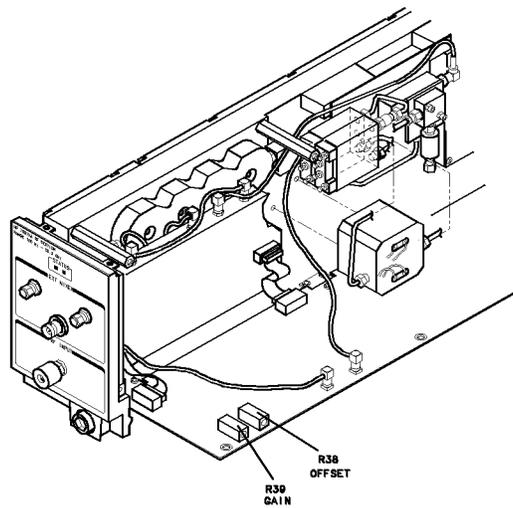
The OFFSET (R38) and GAIN (R39) potentiometers are located on the forward right-hand corner of the A19 power supply/YTF driver when it is placed in service position. (Refer to Figure 8-13.)

1. To adjust the OFFSET potentiometer, adjust A19R38 until the mean of the  $-6$  dB bandwidth is within a specified range of 4.6786 GHz.
2. To adjust the gain potentiometer, adjust A19R39 until the mean center frequency is within a specified range of 20.3214 GHz.

---

**Note** This adjustment is dependent on the HP 70900B local oscillator source TUNE+SPAN output accuracy.

---



**Figure 5-40. A19 OFFSET (R38) and GAIN (R39) Adjustments**

Since the offset and gain adjustments are interactive, the adjustment procedure alternates between adjusting the offset and gain potentiometers until you indicate that the adjustments are finished. After completion of the coarse adjustments, the procedure checks to see if the YTF's mean center frequency is within the specified ranges. If the coarse adjustment passes, the program continues. If it does not, you must continue making adjustments until the procedure passes.

---

**Note** To prevent the YTF from heating up to a temperature which would affect the calibration, the adjustment procedure limits you to 25 seconds in which to perform the gain adjustment. If you exceed this time limit, the procedure reverts to the offset adjustment.

---

After the coarse adjustment is completed, the procedure delays for two minutes to cool the YTF and establish an initial condition at which the YTF is calibrated. After this wait period, the voltage at the front panel tune/span output versus the YTF center frequency is measured at a number of points in each band. From this data, at a given YTF frequency, the voltage at the front panel tune/span output is calculated. The offset and gain DACs are now adjusted to optimize the YTF static tracking of the rear panel tune/span input voltage.

## **Adjustment 06. YTF Alignment**

The procedure next adjusts the break point DAC and finds the optimum delay DAC value. A slow sweep filter routine compares present and previous delta amplitudes. To adjust the offset DAC for the 1H- band, the tune/span input error is calculated. The UUT's tune/span output is measured and corrected using the tune/span input error. The offset DAC is adjusted until the corrected tune/span output is achieved.



## Verification Tests

---

### Overview In this chapter you will learn about:

- Which equipment is required for each verification test by viewing an “Verification Tests Equipment Matrix”
  - Each of the equipment setups used during module verification tests
- 

This chapter contains the test equipment setups for all module verification tests that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated and require a controller running module verification software.

Before You Begin Testing .....	6-2
Overall Test Setup .....	6-4
Test 01. Switch Repeatability (HP 70910A RF Section Only) .....	6-5
Test 02. External Mixer Gain Calibration .....	6-7
Test 03. Gain and Flatness Calibration .....	6-9
Test 04. Flatness Below 50 MHz .....	6-11
Test 05. Microwave Gain and Noise Figure .....	6-13
Test 06. External Mixer Noise Figure .....	6-17
Test 07. Microwave TOI .....	6-19
Test 08. Diagnostics Check .....	6-22
Test 09. Front Panel LEDs Check .....	6-24
Test 10. 21.4 MHz IF Output Response .....	6-25
Test 11. IF Emissions and Harmonics .....	6-27
Test 12. EMIM LO Out Power and Harmonics .....	6-29
Test 13. 1st LO Out Power and Harmonics .....	6-31
Test 14. TUNE+ SPAN+ PRESEL PEAK Output .....	6-33
Test 15. LO Input Amplitude Range .....	6-35
Test 16. Microwave Image Rejection .....	6-37
Test 17. EMIM Image Rejection .....	6-39
Test 18. 2nd Converter Startup .....	6-41
Test 19. Microwave Residual Responses .....	6-43
Test 20. Microwave In-Range Multiples .....	6-45
Test 21. 321.4 MHz IF Output Bandwidth (HP 70910A RF Section Only) .....	6-47

## Before You Begin Testing

Tests / Equipment	LO Source	Full $\mu$ W Source	Scalar Network Analyzer	$\mu$ W Source	Synth. Source	Level Generator	Power Meter #1	$\mu$ W Power Sensor	Power Meter #2	Low Power Power Sensor	Low Freq. Power Sensor	DVM	Calibrated Spectrum Analyzer	Noise Figure Meter	Noise Source
TSCRIPT ITEM	SYN4	SYN1	NA1	SYN2	SYN3	LG1	PM1	MWPS	PM2	LPPS	LFPS	DVM	SA1	NMTR1	NSRC
Test Equipment Calibration Menu		X	X												
Test 01. Switch Repeatability (HP 70910A Only)	X	X	X												
Test 02. External Mixer Gain Calibration	X			X					X						
Test 03. Gain and Flatness Calibration	X	X	X												
Test 04. Flatness Below 50 MHz	X					X							X		
Test 05. Microwave Gain and Noise Figure	X												X	X	X
Test 06. External Mixer Noise Figure	X												X		
Test 07. Microwave TOI	X	X		X											
Test 08. Diagnostics Check	X			X	X		X	X					X		
Test 09. Front Panel LED Check	X														
Test 10. 21.4 MHz IF Output Response	X								X						
Test 11. IF Emissions and Harmonics	X												X		
Test 12. EMIM LO Out Power and Harmonics	X			X			X	X					X		
Test 13. Aux LO Out Power and Harmonics	X			X			X	X					X		
Test 14. TUNE + SPAN + PRESEL PEAK Output	X											X			
Test 15. LO Input Amplitude Range	X						X						X		
Test 16. Microwave Image Rejection	X			X			X						X		
Test 17. EMIM Image Rejection	X			X			X						X		
Test 18. 2nd Converter Startup	X			X			X						X		
Test 19. Microwave Residual Responses	X			X			X						X		
Test 20. Microwave In-Range Multiples	X			X			X						X		
Test 21. 321.4 MHz Output Bandwidth	X			X			X						X		
Utilities Menu	X														

HP 70909A/70910A  
 tmatrix.cdr  
 Rev. 1  
 10/13/97

Figure 6-1. Verification Tests Equipment Matrix

### 6-2 Verification Tests

**Recommended Test Equipment**

For a list of test equipment, accessories, and related critical specifications, refer to “Test Equipment Requirements”, in Chapter 2 or Chapter 4. For a list of ESD accessories, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

**Modules Tested**

Unless otherwise noted, all tests apply to both the HP 70909A RF section and the HP 70910A RF section. In the tests, these modules are often referred to as the UUT (unit under test).

**HP-IB Symbol**

The Hewlett-Packard Interface Bus (HP-IB) symbol on verification test setup diagrams indicate that the controller and other instruments need to link together by means of HP-IB.

---

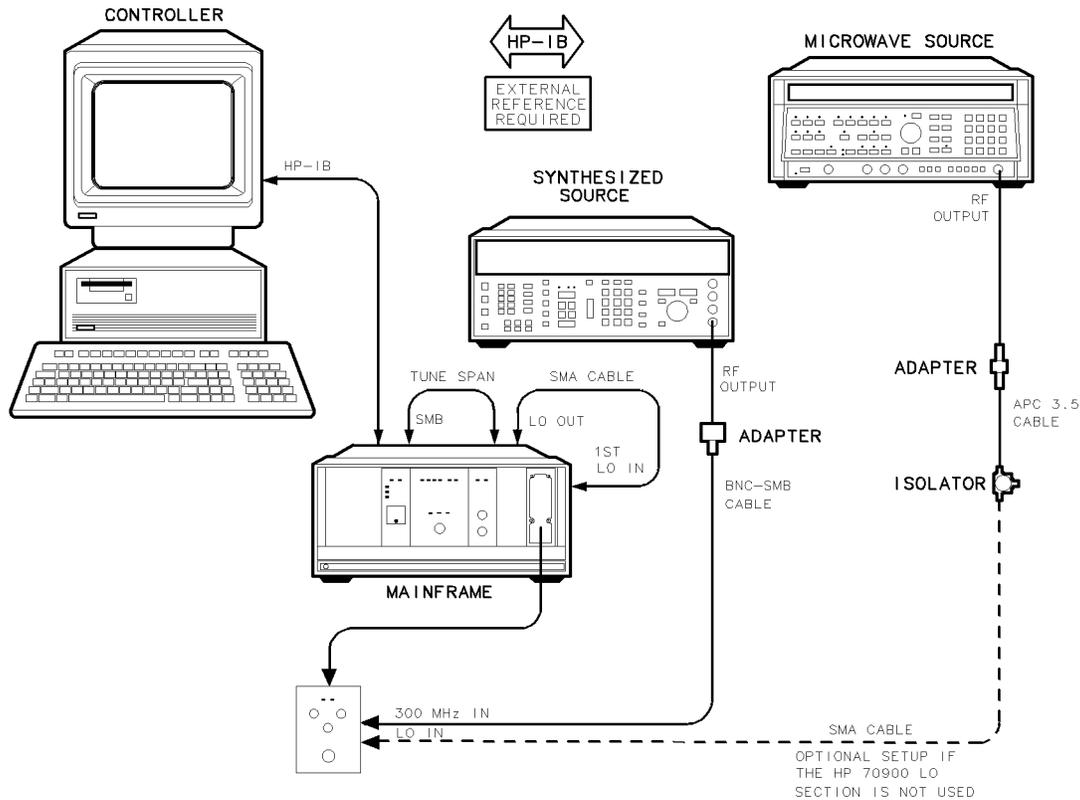
**Note** In all tests that require the microwave source to be connected to the network analyzer through HP-IB, the source must be located at address 19.

---

**External Frequency Reference**

The external reference symbol on a test setup diagram indicates that the HP 70000 Series modular spectrum analyzer system and equipment such as sources, analyzers, and frequency counters must connect to the same frequency standard. (Refer to “External Frequency Reference Requirements” in Chapter 4.)

## Overall Test Setup



epa3\_1t

Figure 6-2. Overall RF Section Verification Test Setup

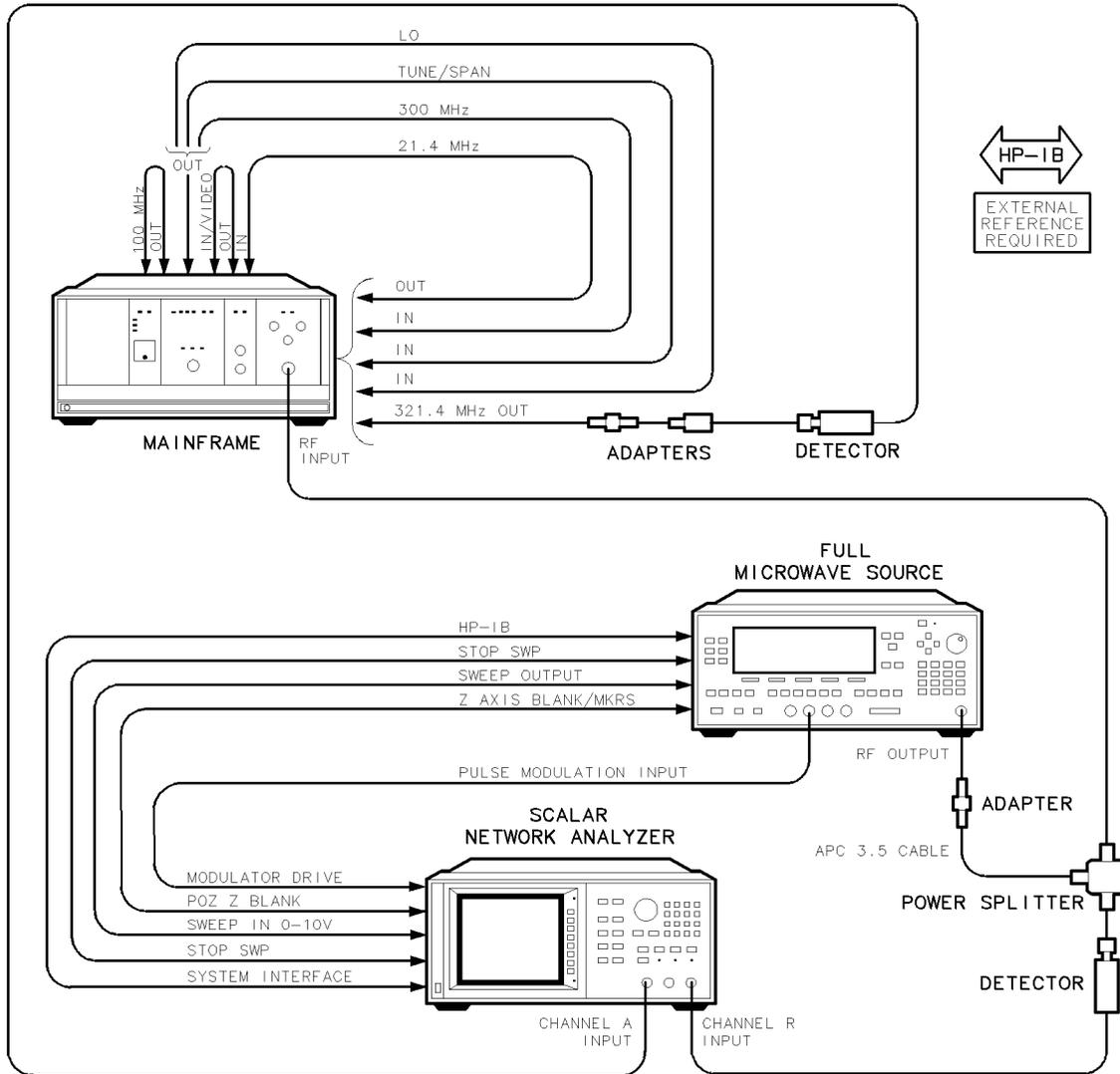
### Test Equipment

### Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Cable .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 5021-5450 260 mm SMA(m) to SMA(m)
Adapter .....	HP 1250-0780 50Ω N(m) to BNC(f)
For optional LO setup	
Isolator .....	HP 0955-0204 microwave isolator
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The basic overall RF section setup in Figure 6-2 is applicable to all RF section verification tests.

**Test 01. Switch Repeatability - HP 70910A Only**



SCB20

**Figure 6-3. Equipment Setup for Test 01. Switch Repeatability - HP 70910A Only**

**Test 01. Switch Repeatability - HP 70910A Only**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Full microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Network analyzer .....	HP 8757D scalar network analyzer
Power splitter .....	HP 11667B power splitter
Detector (2 required) .....	HP 85025B detector
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable .....	HP 8120-4921 91 cm 50 $\Omega$ APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (4 required) .....	HP 8120-1840 122 cm 50 $\Omega$ coaxial BNC(m) to BNC(m)
Adapter .....	HP 1250-0674 50 $\Omega$ SMB(m) to SMA(f)
Adapter .....	HP 1250-0672 50 $\Omega$ SMB(f) to SMB(f)
Adapter .....	HP 5061-5311 50 $\Omega$ APC-3.5(f) to APC-3.5(f)

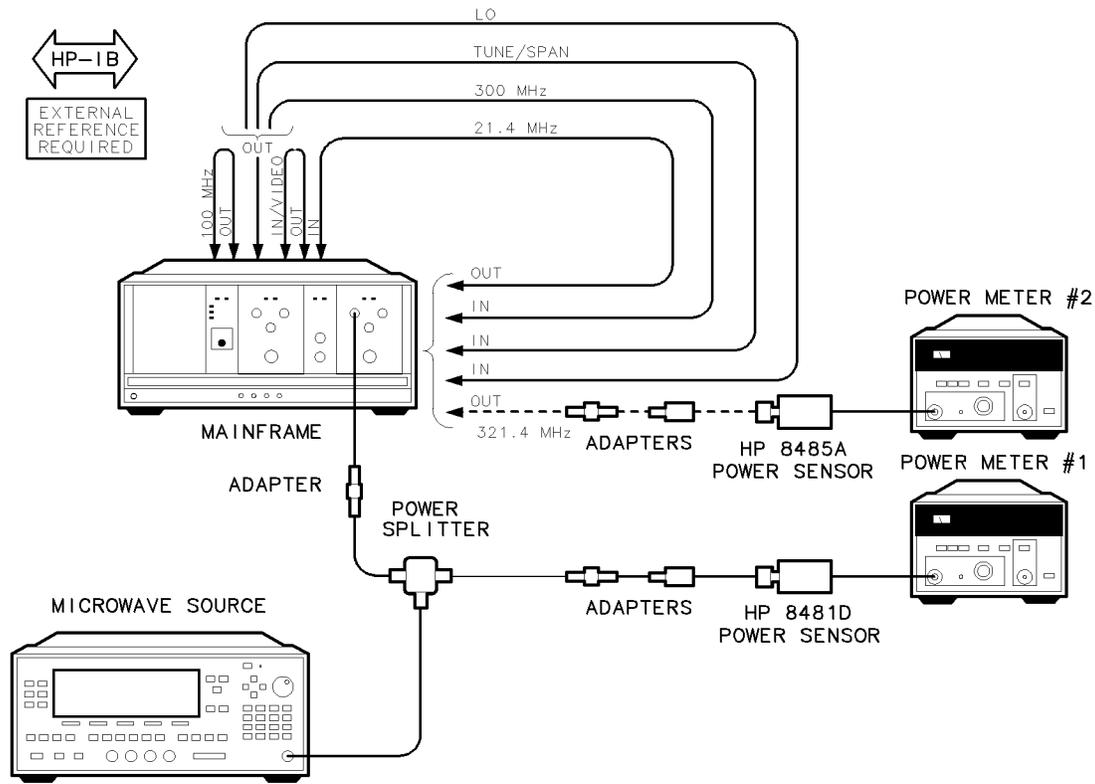
The purpose of this verification test is to measure the amplitude repeatability of the switch used to select the BYPASS or YTF path in the HP 70910A RF section.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 01. Switch Repeatability. Refer to Chapter 3 for information about running the software.

When performing this verification test, the network analyzer is placed in the A/R mode and channel 2 is turned off. The RF source is set to a CW frequency of 26.5 GHz and an output power level of  $-7$  dBm. The center frequency of the RF section is set to 26.5 GHz, a span of 0 Hz, and the switch mode is set to the preselected path.

The network analyzer sweeps and the peak value of the trace is noted. The bypass mode of the UUT is then selected. The network analyzer sweeps again and the peak value of the trace is noted. Each switch path is measured a specified number of times and the difference between maximum and minimum values is compared to test limits.

**Test 02. External Mixer Gain Calibration**



sca5

**Figure 6-4. Equipment Setup for Test 02. External Mixer Gain Calibration Test Setup**

**Test Equipment**

**Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor (2 required) .....	HP 8481D N(m) power sensor
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter .....	HP 1250-0672 50Ω SMB(f) to SMB(f)

The purpose of this verification test is to measure the gain from the HP 70909A or HP 70910A RF section’s front panel EXT MIXER IF input to the HP 70909A or HP 70910A RF section’s rear panel 321.4 MHz OUT with the A6 programmable gain amplifier set for minimum gain.

**Test 02. External Mixer Gain Calibration**

---

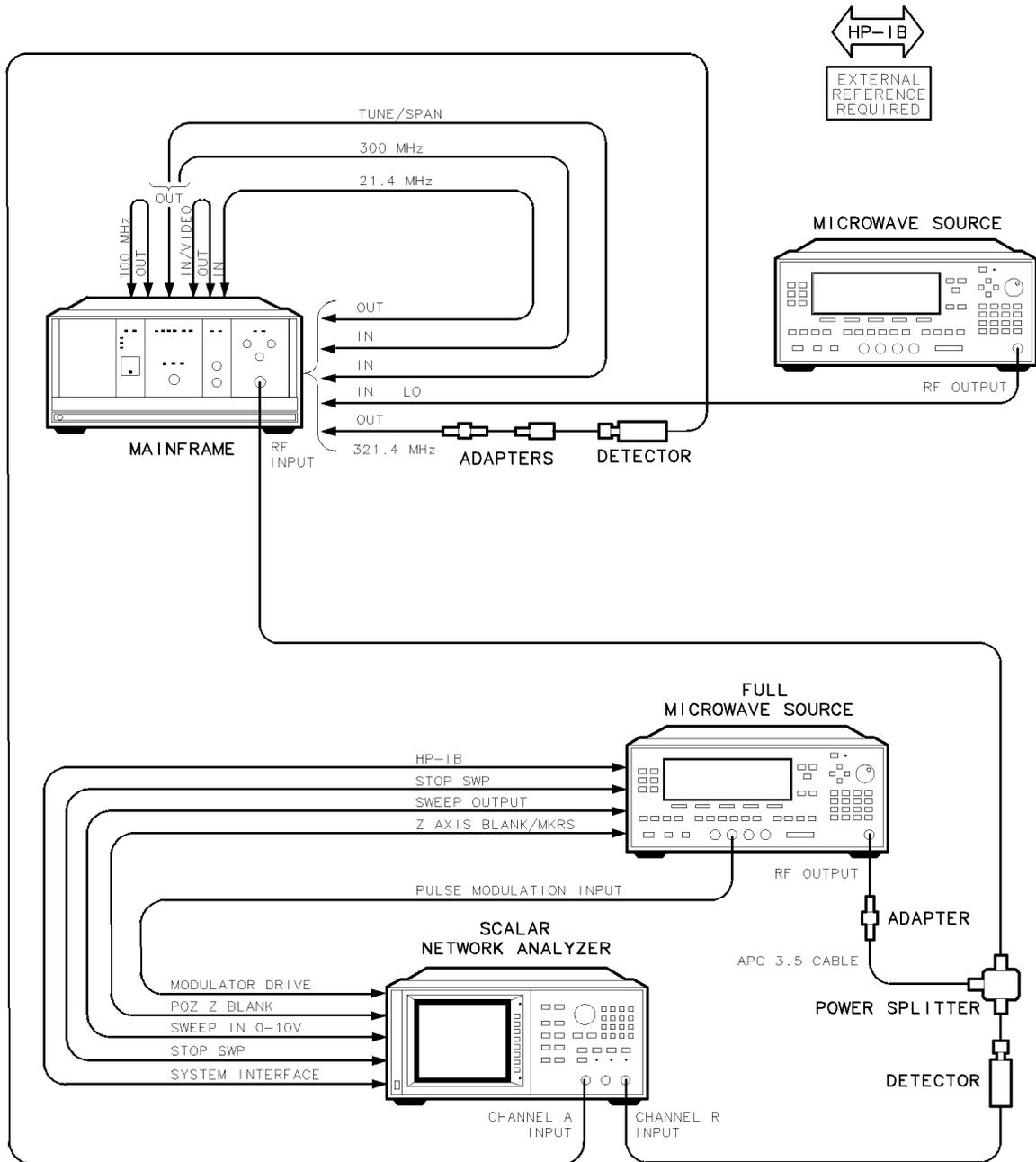
**Note** If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 02. External Mixer Gain Calibration. Refer to Chapter 3 for information about running the software.

When performing this verification test, the microwave source is set to a CW frequency and an input power that is measured at power sensor #1. The 321.4 MHz output of the RF section is measured with power sensor #2. The gain is calculated by subtracting the power reading at sensor #1 from the reading at sensor #2. If the gain is within test limits, it is stored in EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

Test 03. Gain and Flatness Calibration



sca20

Figure 6-5. Equipment Setup for Test 03. Gain and Flatness Calibration

**Test 03. Gain and Flatness Calibration**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Full microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Network analyzer .....	HP 8757D scalar network analyzer
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Detector (2 required) .....	HP 85025B detector
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (4 required) .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter .....	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)

The purpose of this verification test is to measure the gain of the RF section from 50 MHz to 26.5 MHz and assure that it will meet the test limits for amplitude accuracy and stores the flatness correction values to EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

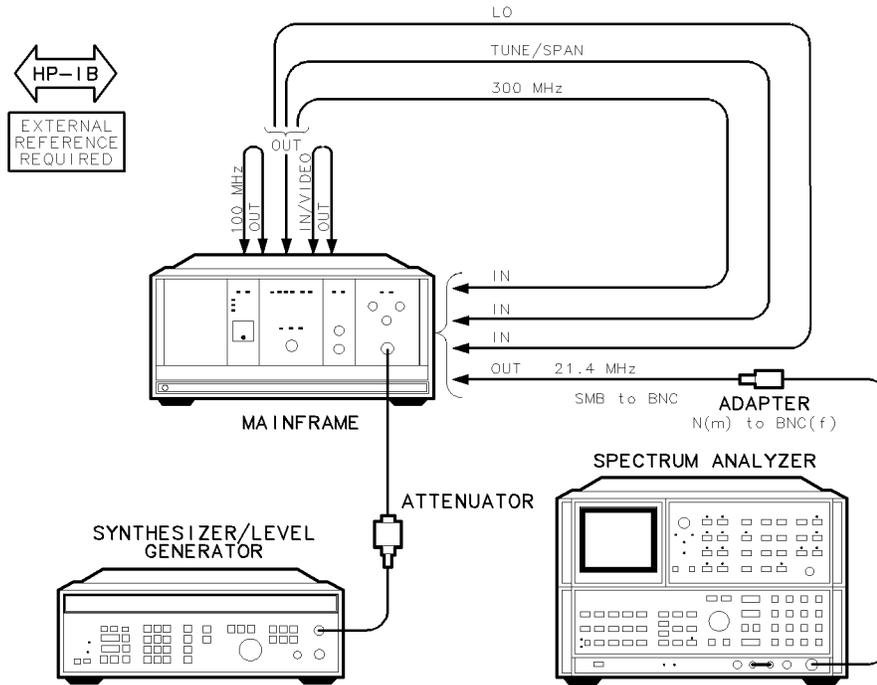
**Performing the initial calibration procedure**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 03. Gain and Flatness Calibration. Refer to Chapter 3 for information about running the software.

**Performing the gain and flatness measurement**

When performing this verification test, the microwave source and the local oscillator are stepped to measure the gain of the RF section from 50 MHz to 26.5 MHz at the exact frequencies used during the calibration. The preselector peak function in the HP 70900B local oscillator source is utilized to find the peak, a sweep is taken, and the A/R measurement is made. This measurement generates the A/R data necessary to calculate the module gain. A flatness optimization routine is employed to find the module flatness correction values that will yield the best overall peak to peak flatness. These flatness correction values are stored to EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

Test 04. Flatness Below 50 MHz



SCA6

Figure 6-6. Equipment Setup for Test 04. Flatness Below 50 MHz

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Level generator .....	HP 3335A synthesizer/level generator
Spectrum analyzer .....	HP 8566B spectrum analyzer
Attenuator .....	HP 8493C Option 006 coaxial fixed attenuator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)

**Test 04. Flatness Below 50 MHz**

The purpose of this verification test is to measure the flatness below 50 MHz on the RF section. It is part of flatness calibration.

---

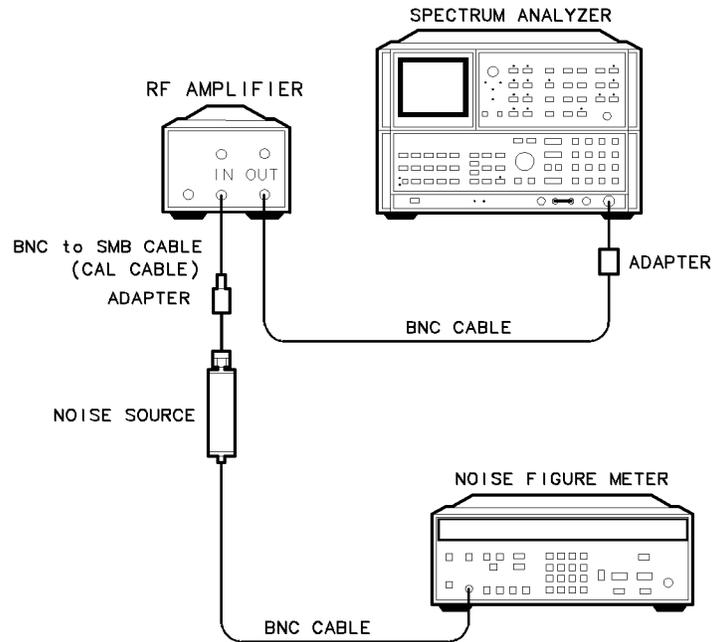
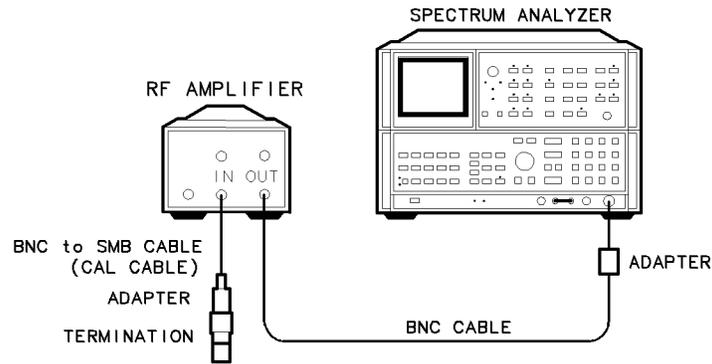
**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 04. Flatness Below 50 MHz. Refer to Chapter 3 for information about running the software.

When performing this verification test, the level generator steps logarithmically from 50 MHz to the minimum frequency of the module. At each RF input frequency the 21.4 MHz output of the RF section is measured. This test data is combined with the 1H– band test data from Test 03. Gain and Flatness Calibration to assure that the UUT meets the test limits for flatness and amplitude accuracy.

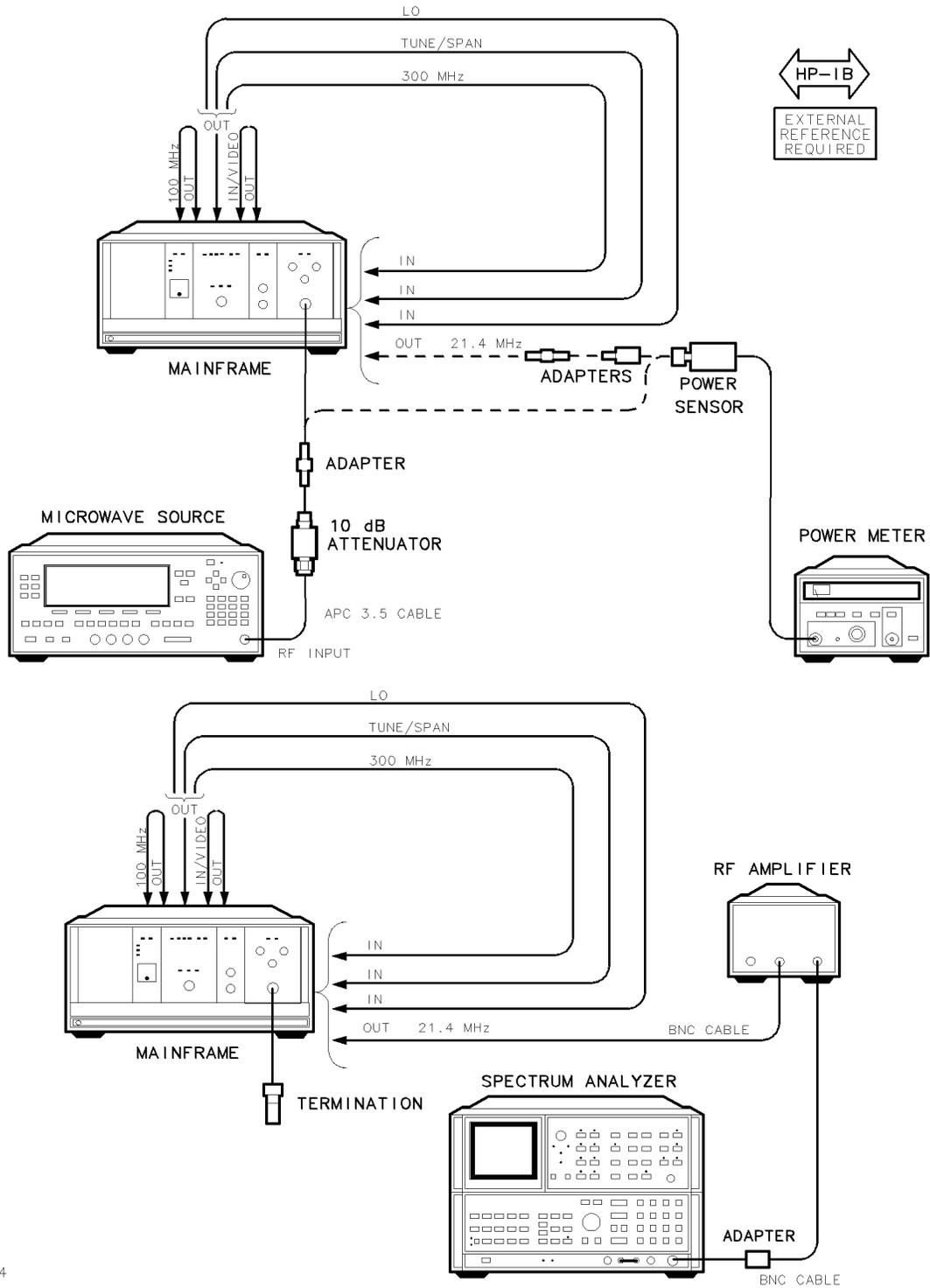
Test 05. Microwave Gain and Noise Figure



scb41

Figure 6-7. Equipment Setup for Noise Figure Calibration

Test 05. Microwave Gain and Noise Figure



scb24

Figure 6-8. Equipment Setup for Gain Calibration and Measurement

**Test 05. Microwave Gain and Noise Figure**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Spectrum analyzer .....	HP 8566B spectrum analyzer
Noise figure meter .....	HP 8970B noise figure meter
Noise source .....	HP 346C broadband noise source
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Attenuator .....	HP 8493C Option 010 coaxial fixed attenuator
Amplifier .....	HP 8447A RF amplifier
Termination .....	HP 909D Option 011 50Ω 3.5 mm(f) termination
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable (2 required) .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 8120-5140 91 cm 50Ω N(m) to N(m)
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter .....	HP 1250-0672 50Ω SMB(f) to SMB(f)

The purpose of this verification test is twofold.

1. It characterizes the noise performance and gain of the test system and the output power of the RF source.
2. It measures the gain and noise figure of the RF section.

---

**Note**                      If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Performing the noise figure calibration**

1. Connect the equipment as shown in Figure 6-7. The CAL cable will need to reach the 21.4 MHz output from the DUT.
2. After a measurement is taken, remove the 50 ohm load from the RF amplifier input and connect the noise source and noise figure meter to the input of the amplifier.

Use the same cable and connectors that will be used in the measurement part of the test.

**Performing the gain calibration**

1. Connect the power sensor to the microwave source through the 10 dB attenuator as shown in Figure 6-8.

Use the same cable and connectors that will be used in the measurement part of this test.

**Test 05. Microwave Gain and Noise Figure****Performing the gain measurement**

1. Remove the power sensor and connect the microwave source through the 10 db attenuator to the RF input of the module as shown in test setup illustration for this procedure.
2. Connect the power sensor to the DUT 21.4 MHz output.

Use the same cable and connectors that were used in the calibration portion of this test.

**Performing the noise figure measurement**

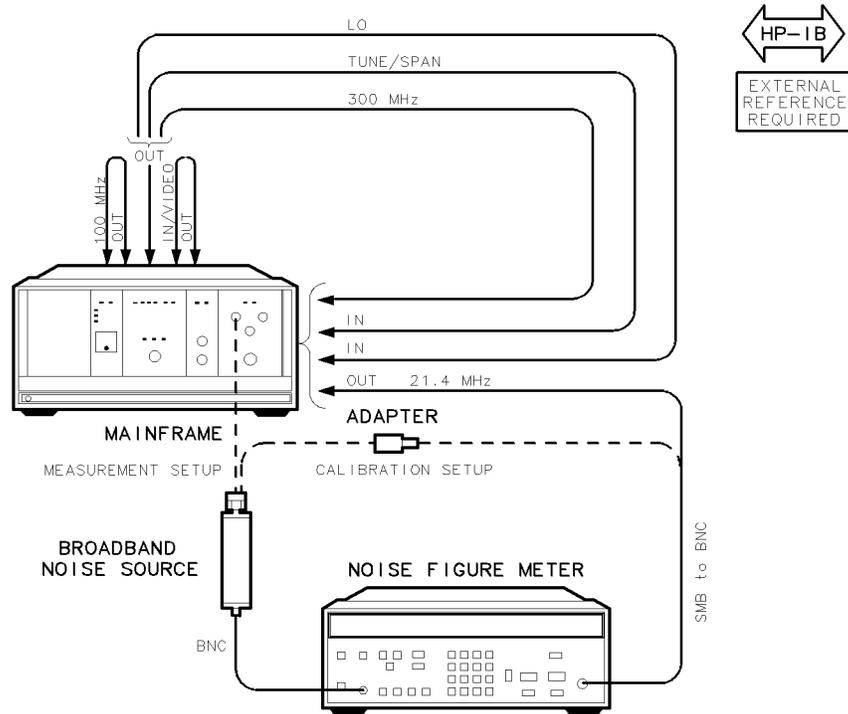
1. Connect the equipment as shown in Figure 6-8.
2. Disconnect the microwave source from the RF input, and terminate the RF input with a 50 ohm load.
3. Remove the power sensor from the 21.4 MHz OUT port.
4. Connect the input of the RF amplifier to the 21.4 MHz OUT port.
5. Connect the output of the RF amplifier to the spectrum analyzer.

The calibration section of this test measures the noise contributed by the test system and this data is used to determine the noise performance of the RF section. It determines the appropriate setting for the synthesized sweeper to achieve the desired power level into the RF input of the module.

The test also measures the gain of the RF section and the noise power output, and then recalls the flatness correction data to calculate the effective noise figure of the module. The measurement is compared with test limits to ensure that the RF section noise level is not excessive.

The noise figure is an indicator of the excess noise added by the DUT. The DUT noise figure relates directly to the HP 70000 Series modular spectrum analyzer system "Displayed Average Noise Level" specification. The combined effect of noise added by both the RF section (DUT) and the IF section, plus digital correction terms for gain yields the minimum level of displayed noise for the system. At lower frequencies (< 10 MHz), LO feed-through and spectral impurities cause an increase to the minimum displayed level and must be combined with the module noise level for the system specification; they are not measured in this test or included in the DUT's noise figure limit.

Test 06. External Mixer Noise Figure



SCB25

Figure 6-9. Equipment Setup for Test 06. External Mixer Noise Figure

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Noise source .....	HP 346C broadband noise source
Noise figure meter .....	HP 8970B noise figure meter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)

**Test 06. External Mixer Noise Figure**

The purpose of this module verification test is to measure the noise figure of the RF section from the external mixer IF input to the 21.4 MHz output. The noise figure is an indicator of the excess noise added by the RF section at a particular RF frequency.

---

**Note**                    If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Performing the initial calibration procedure**

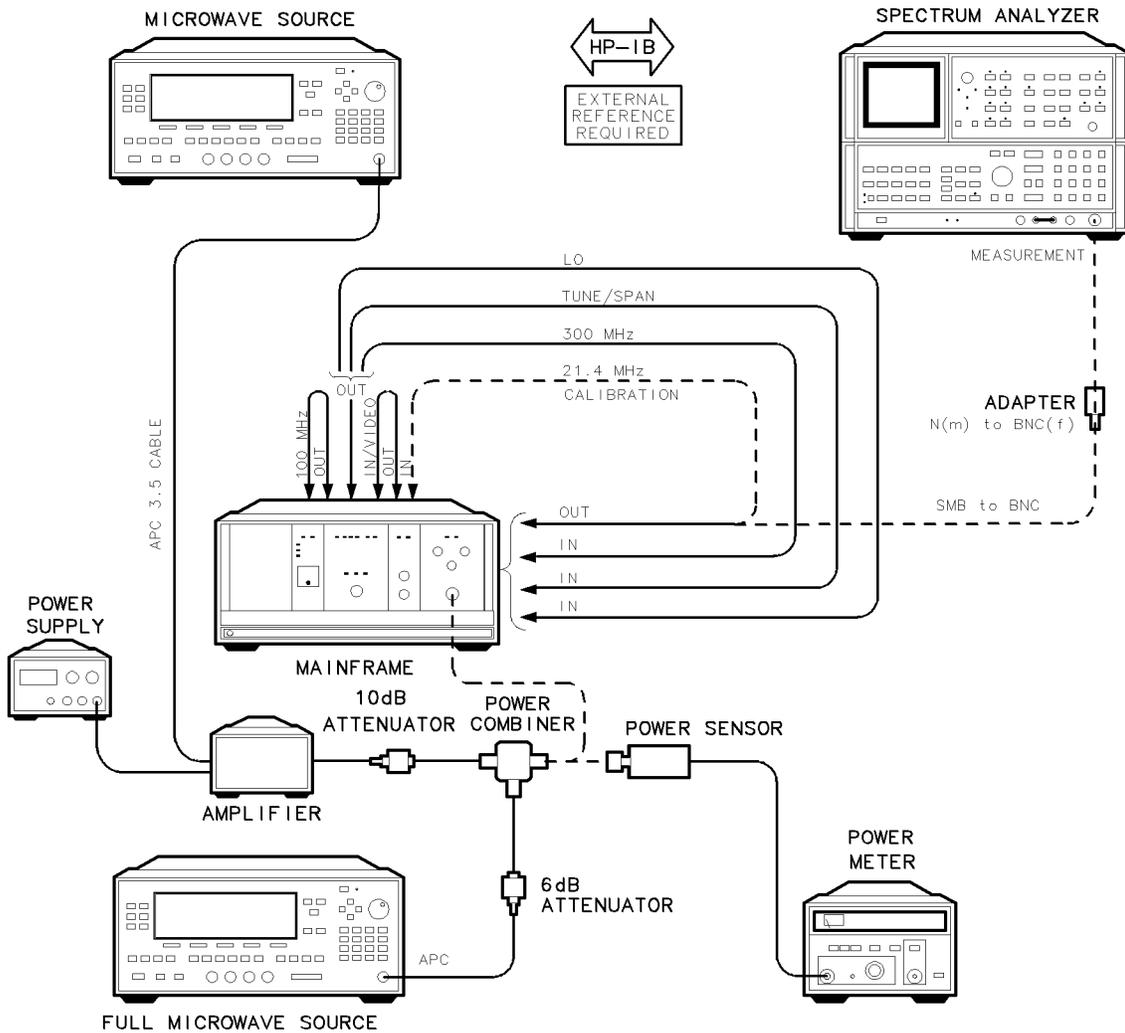
1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Connect the noise source drive output to the 28 Vdc bias input of the noise source.
3. Connect the output of the noise source to the input of the noise meter.
4. Load and run Test 05. Microwave Gain and Noise Figure. Refer to Chapter 3 for information about running the software.
5. The calibration and setup check of the noise figure meter and the noise source is performed.
6. Remove the output of the noise source from the input of the noise meter.

**Performing the gain and noise figure measurement**

1. Connect the rear panel 21.4 MHz OUT connector of the RF section to the input of the noise figure meter.
2. Connect the output of the noise source directly to the front panel EXT MIXER IF input connector of the RF section.

When performing this verification test, the RF section is set to external mixer mode. The gain is measured and then the noise figure from the external mixer IF input to the 21.4 MHz IF output is measured. The noise figure is compared to a limit which ensures that the RF section contributes no more than its specified share of noise to the level of displayed noise for the system.

Test 07. Microwave TOI



SCA5A

Figure 6-10. Equipment Setup for Test 07. Microwave TOI

**Test 07. Microwave TOI**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Full microwave source (2 required) ...	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power combiner .....	HP 11636B power divider/combiner
Power supply .....	HP 87421A power supply
Amplifier .....	HP 83006A microwave amplifier
Attenuator .....	HP 8493C Option 010 coaxial fixed attenuator
Attenuator .....	HP 8493C Option 006 coaxial fixed attenuator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-4921 91 cm 50 $\Omega$ APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 85680-60093 123 cm 50 $\Omega$ BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50 $\Omega$ N(m) to BNC(f)

The purpose of this module verification test is to measure the third order intercept (TOI) of the RF section from 10 MHz to 26.5 GHz.

---

**Note**                      If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Performing the initial calibration procedure**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 07. Microwave TOI. Refer to Chapter 3 for information about running the software.
4. The power level for the microwave source is determined at each test frequency.

When performing this verification test, the calibration procedure stores the power reading to be used during measurement for each test frequency.

**Determining Preselector DAC settings**

1. Remove the power sensor from the output of the power combiner and connect the power combiner directly to the RF input of the UUT.
2. Connect the 21.4 MHz output of the RF section to the HP 70902A IF section’s 21.4 MHz IF input.

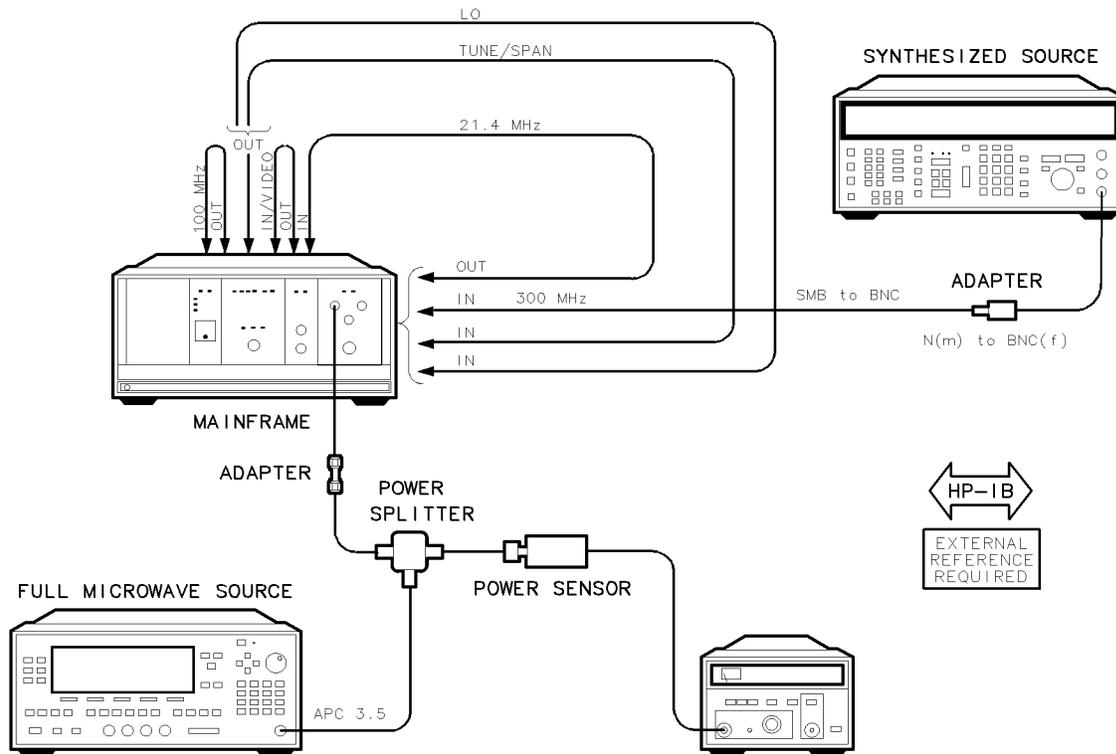
To determine DAC settings, the microwave source is set to the same RF IN frequency as the RF section and its output power is set to the value determined in the calibration. The RF section and the microwave source are stepped up in frequency to each test frequency, the preselector is peaked, and the DAC value is read and stored.

**Measuring MW TOI (Narrow IF)**

With the power combiner connected directly to the RF input of the UUT, connect the 21.4 MHz OUT of the RF section to the RF INPUT of the spectrum analyzer.

To measure TOI at each frequency, the DUT is set to the same frequency as the microwave source. The 21.4 MHz output power is noted (as measured on the spectrum analyzer). The full microwave source is set to 47 KHz higher than the microwave source. The DUT is set to the same frequency as the full microwave source. The power level of the full microwave source is adjusted to the same power level that was measured previously on the spectrum analyzer. The DUT is then tuned to calculated TOI frequencies, their power levels are measured by the spectrum analyzer, and the TOI is calculated. This process is repeated for each test frequency.

## Test 08. Diagnostics Check



SCA5B

Figure 6-11. Equipment Setup for Test 08. Diagnostics Check

### Test Equipment

### Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Full microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Synthesized source .....	HP 8662A synthesized signal generator
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1250-1744 50Ω APC-3.5(f) to N(m)

The purpose of this verification test is to verify proper operation of the internal diagnostic detectors that trigger the following RF section errors:

- 2nd converter unlocked
- 300 MHz level
- 21.4 output level
- TUNE + SPAN input level

---

**Note** If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 08. Diagnostics Check. Refer to Chapter 3 for information about running the software.

When performing this test, the diagnostic detectors are checked in the following order:

#### **2nd converter unlock**

The 2nd converter unlock detector is monitored while the RF power of the synthesized source is decreased in increments until the detector goes high. This indicates the 2nd converter is unlocked. The synthesized source power is increased one step and then decreased in increments until the bit goes low. The synthesized source output power setting is read and compared to the test limit. The power level should be greater than the test limit.

#### **300 MHz level**

The 300 MHz level detector is monitored while the RF power of the synthesized source is decreased in increments until the 300 MHz level detector goes high which indicates the 300 MHz power is too low. The synthesized source power is increased and then decreased in increments until the bit goes low. The synthesized source output power setting is read and compared to the test limit. The power level should be greater than the test limit.

#### **21.4 output level**

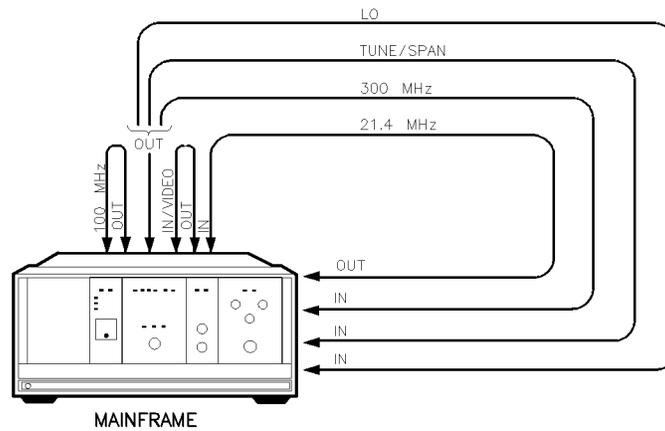
The diagnostics IF level is monitored while the synthesized source power is decreased in increments until the IF level detector goes high which indicates that the level is too low. The synthesized source power is increased in increments until the 21.4 output level detector goes low. The RF input power is measured with the power meter and compared to the test limit.

#### **TUNE + SPAN input level**

The RF section's tune + span input signal is temporarily disconnected and the tune + span level detector is checked to verify that it goes high.

The remaining diagnostic detectors are checked in other tests. EEPROM WRITER PROTECT is checked in Test 03. Gain and Flatness Calibration and the First LO Level Detector is checked in Test 15. LO Input Amplitude Range.

## Test 09. Front Panel LEDs Check



SCA1

**Figure 6-12. Equipment Setup for Test 09. Front Panel LEDs Check**

### Test Equipment

### Preferred Model Numbers

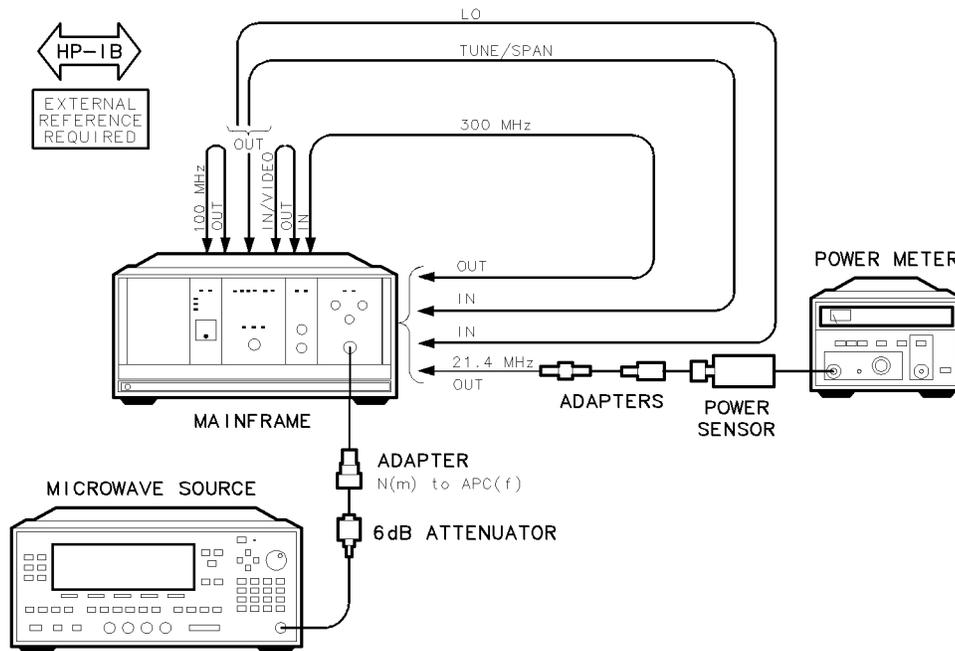
Controller .....	HP 9000 Series 300 controller
Display .....	HP 70004A color display
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Synthesized source .....	HP 8662A synthesized signal generator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)

The purpose of this verification test is to visually verify that the front panel LEDs are functioning properly. It tests the LEDs and the ability of the RF section’s internal processor to control them. It does not test error/diagnostics sensing.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 09. Front Panel LEDs Check. Refer to Chapter 3 for information about running the software.

You are prompted to press various keys on the system display. You are then prompted to indicate the state of the LEDs on the DUT. Based on this information, the PASS/FAIL status for this test is determined.

**Test 10. 21.4 MHz IF Output Response**



SCA5C

**Figure 6-13. Equipment Setup for Test 10. 21.4 MHz IF Output Response**

**Test Equipment**

**Preferred Model Numbers**

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8482A N(m) power sensor
Attenuator .....	HP 8493C Option 006 coaxial fixed attenuator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter .....	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter .....	HP 1250-1744 50Ω APC-3.5(f) to N(m)

**Test 10. 21.4 MHz IF Output Response**

The purpose of this module verification test is to measure the 21.4 MHz IF output passband response of the DUT. Flatness is measured from 21.4 MHz  $\pm$ 2.5 MHz. The 21.4 MHz passband response should be +0.4/−0.6 dB relative to the amplitude at 21.4 MHz, and the 3 dB bandwidth should be greater than 9 MHz.

---

**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

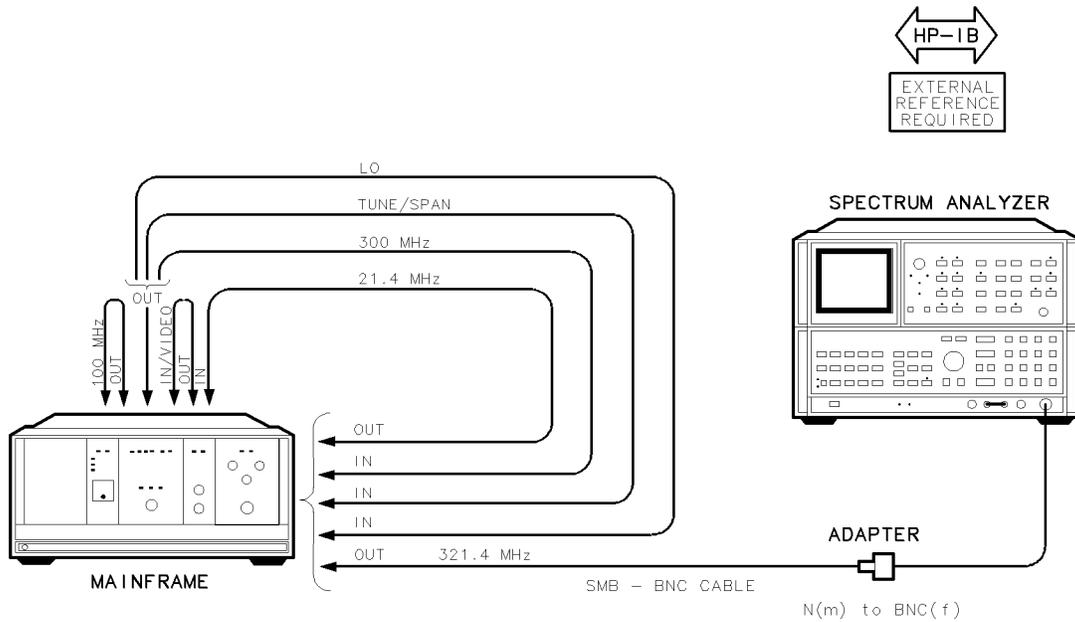
1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 10. 21.4 MHz IF Output Response. Refer to Chapter 3 for information about running the software.

When performing this verification test, the power level of the microwave source is adjusted and the power meter reading is noted as the reference power level at 21.4 MHz.

The center frequency of the local oscillator is stepped in increments through a specified offset range. This generates IF output responses offset from the nominal 21.4 MHz. The power meter measures the IF output of the UUT at each frequency offset.

The LO frequency is stepped rather than the RF frequency so that the RF input level remains constant without the need for calibration or amplitude correction at each frequency. It is assumed that small variations of the LO input versus frequency will not affect the IF output level.

Test 11. IF Emissions and Harmonics



SCB31

Figure 6-14. Equipment Setup for Test 11. IF Emissions and Harmonics

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz-300 kHz) .....	HP 70902A IF section
Spectrum analyzer .....	HP 8566B spectrum analyzer
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)

**Test 11. IF Emissions and Harmonics**

The purpose of this module verification test is to measure the level of the 300 MHz reference signal present at 321.4 MHz rear panel OUT.

---

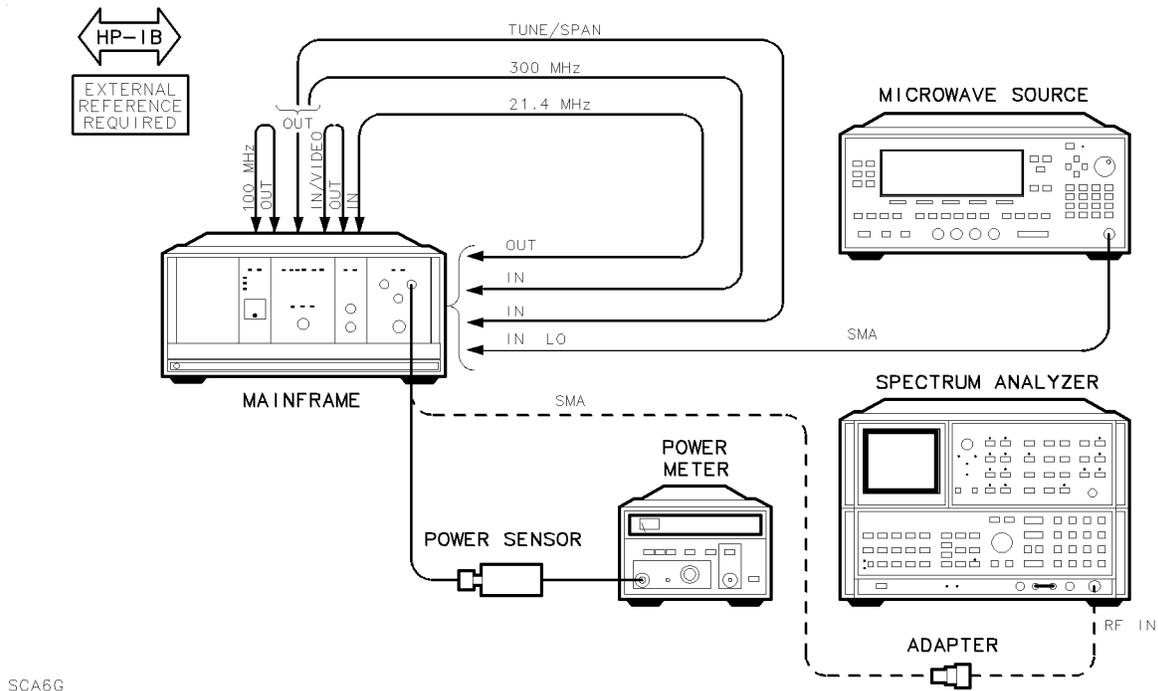
**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 11. IF Emissions and Harmonics. Refer to Chapter 3 for information about running the software.

When performing this verification, the level of the 300 MHz signal at the 321.4 MHz output of the RF section is measured, compared to test limits.

Test 12. EMIM LO Out Power and Harmonics



SCA6G

Figure 6-15. Equipment Setup for Test 12. EMIM LO Out Power and Harmonics

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Cable (2 required) .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1250-1744 50Ω APC-3.5(f) to N(m)

**Test 12. EMIM LO Out Power and Harmonics**

The purpose of this verification test is to measure the absolute amplitude of the fundamental and the relative second harmonic amplitude of the HP 70909A or HP 70910A RF section's front panel EXT MIXER LO output.

---

**Note**                    If this test fails, refer to "Verification Test Problems" in Chapter 7 for the troubleshooting instructions related to this test.

---

**Measuring EMIM LO output**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Connect the power meter to the external mixer LO output port.
3. Set the mainframe line switch to ON.
4. Load and run Test 12. EMIM LO Out Power and Harmonics. Refer to Chapter 3 for information about running the software.

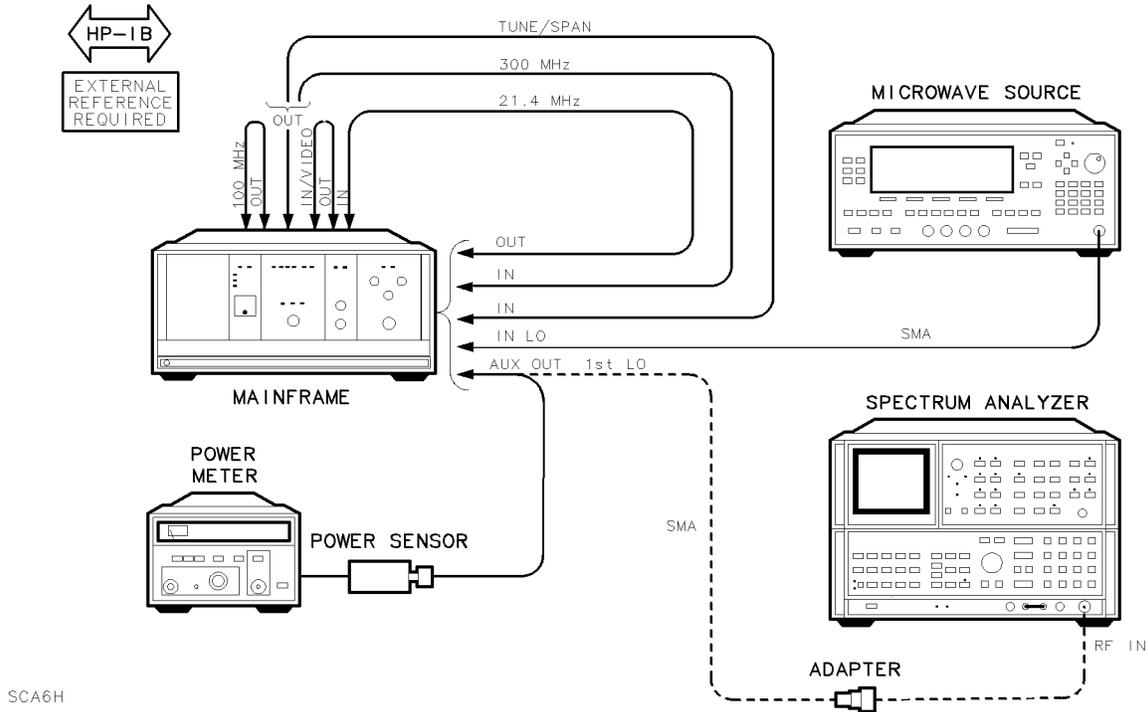
When performing this verification test, the power level of the fundamental LO output is first measured at all input frequencies.

**Measuring harmonics**

1. Disconnect the power meter from the external mixer LO output port.
2. Connect the spectrum analyzer to the external mixer LO output port.

The spectrum analyzer measures the level of the fundamental and the relative level of the second harmonic.

Test 13. 1st LO Out Power and Harmonics



SCA6H

Figure 6-16. Equipment Setup for Test 13. 1st LO Out Power and Harmonics

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
External reference ....	Refer to "External Frequency Reference Requirements" in Chapter 4.
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Cable (2 required) .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Adapter .....	HP 1250-1744 50Ω APC-3.5(f) to N(m)

**Test 13. 1st LO Out Power and Harmonics**

The purpose of this verification test is to measure the absolute amplitude of the fundamental and the relative second harmonic amplitude of the auxiliary LO output port.

---

**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Measuring 1st LO output**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Connect the power meter to the 1st LO OUT.
3. Set the mainframe line switch to ON.
4. Load and run Test 13. 1st LO Out Power and Harmonics. Refer to Chapter 3 for information about running the software.

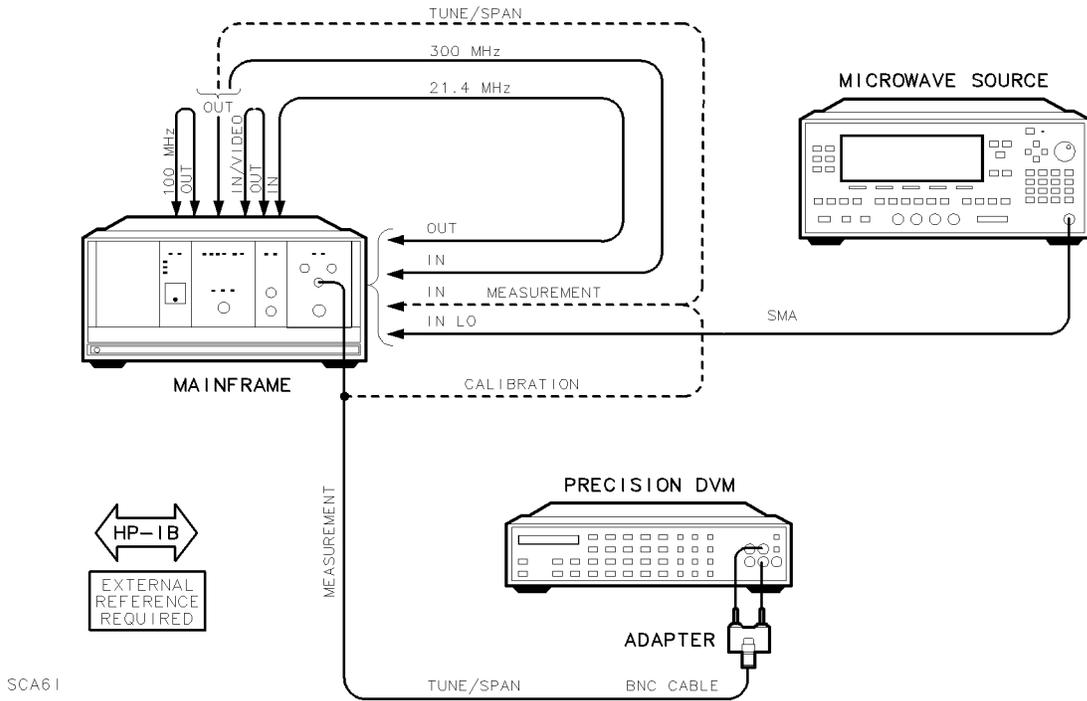
When performing this verification test, the power level of the fundamental LO output is measured with the power meter at all LO input frequencies.

**Measuring harmonics**

1. Disconnect the power meter from the 1st LO OUT.
2. Connect the spectrum analyzer to the 1st LO OUT.

The spectrum analyzer measures the level of the fundamental and the relative level of the second harmonic. This sequence of measurements is repeated for the external mixer A band (26.5 to 40 GHz).

Test 14. TUNE + SPAN + PRESEL PEAK Output



SCA61

Figure 6-17. Equipment Setup for Test 14. TUNE + SPAN + PRESEL PEAK Output

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Precision DVM .....	HP 3456A digital multimeter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Adapter .....	HP 1251-2277 50Ω BNC(f) to dual banana plug

**Test 14. TUNE + SPAN + PRESEL PEAK Output**

The purpose of this verification test is to verify the front panel TUNE/SPAN output voltage (0.5 V/GHz). When the RF INPUT is selected, the TUNE/SPAN output can be used to drive a tracking generator (non-MMS type). When the external mixer mode is selected, this connector is used to tune the preselected MM mixers.

---

**Note**                    If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Measuring the RF section tune/span input**

1. Connect the equipment as shown in the test setup illustration for calibration.
2. Connect the HP 70900B local oscillator source tune/span output to the HP 3456A digital multimeter.
3. Set the mainframe line switch to ON.
4. Load and run Test 14. TUNE+SPAN+PRESEL PEAK Output. Refer to Chapter 3 for information about running the software.

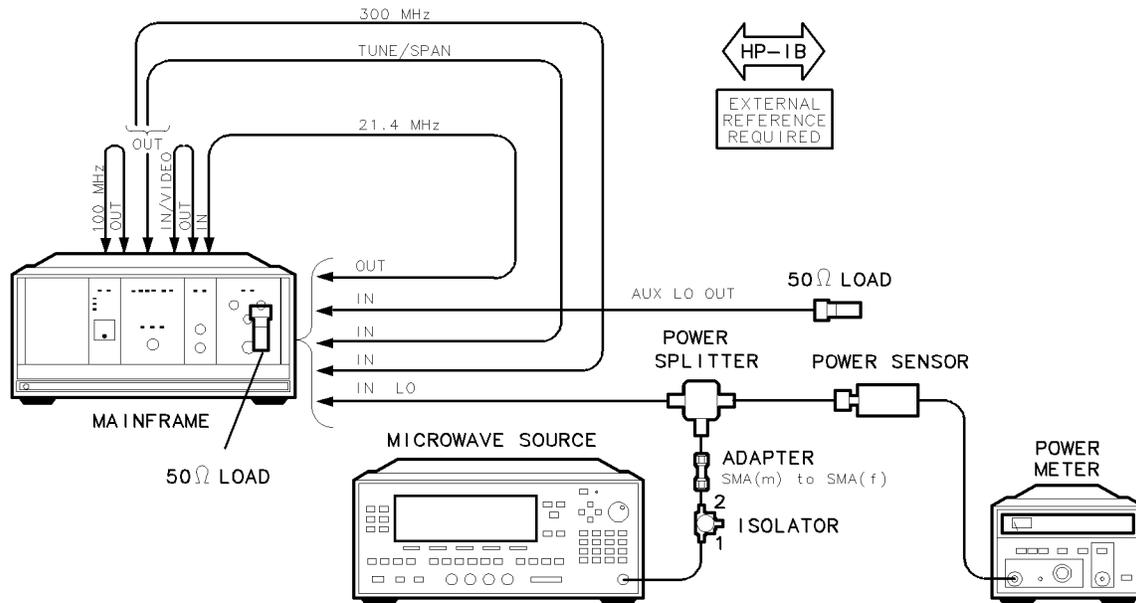
When performing this verification test, the RF input is selected and the input voltage to the DUT is measured. The measured tune/span input is subtracted from the calculated tune/span input to find the tune/span input error.

**Measuring the RF section tune/span output**

Connect the local oscillator tune/span output to the tune/span output of the UUT.

The tune/span output error is then found and compared to the tune/span error test limit. All measured tune/span input and output voltage values are stored in EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

Test 15. LO Input Amplitude Range



SCA6K

Figure 6-18. Equipment Setup for Test 15. LO Input Amplitude Range

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Termination (2 required) .....	HP 909D Option 011 50Ω 3.5 mm(f) termination
Isolator .....	HP 0955-0204 microwave isolator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1159 50Ω SMA(m) to SMA(m)

**Test 15. LO Input Amplitude Range**

The purpose of this verification test is to determine minimum input power level required for the A18 LO leveling amplifier to stay leveled. The test does not find the maximum input level because it is beyond the range of the LO source.

---

**Note**                    If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

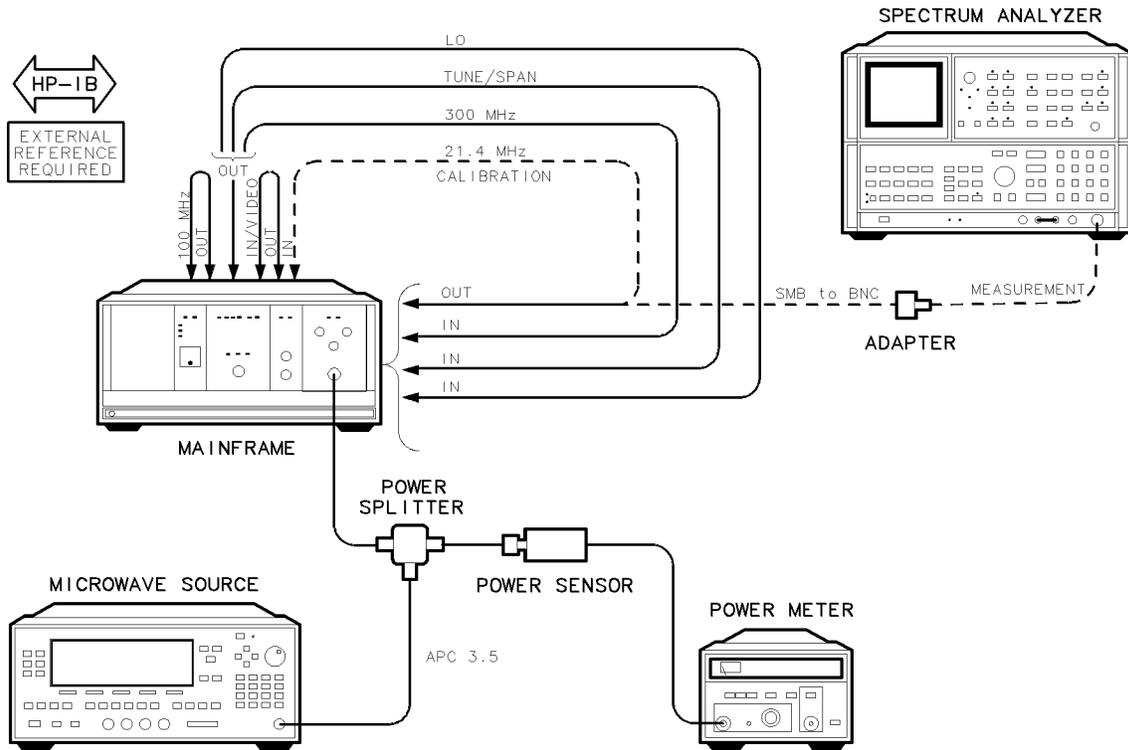
1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 15. LO Input Amplitude Range. Refer to Chapter 3 for information about running the software.

When performing this verification test, the RF section is set to the external mixer band. The LO leveled detector is checked.

- If it indicates an unlevelled condition, the test is failed.
- If a leveled condition exists, the microwave source power level is decreased until an unlevel occurs.

When the power level has been adjusted within range of the minimum power required for a leveled condition, the power meter is read and the LO IN frequency and power level are noted. The microwave source is stepped up in frequency and the minimum leveled-power level for the new frequency is found and noted. This process is repeated for all input frequencies. All of the noted power levels are examined to find the maximum point. The power level and the associated frequency are displayed.

Test 16. Microwave Image Rejection



sca61

Figure 6-19. Equipment Setup for Test 16. Microwave Image Rejection

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)

**Test 16. Microwave Image Rejection**

The purpose of this module verification test is to measure the in-band image responses.

Inadequate image rejection manifests itself in a system as false responses indicated at 42.8 MHz and 642.8 MHz away from the frequency of the applied signal. These responses are due to the images of the last and second converters respectively. The false responses appear below the frequency of the incoming signal.

- The 42.8 MHz response is a function of first and second IF selectivity and the last mixer.
- The 642.8 MHz response is a function of the first IF selectivity and the second mixer which is a linear response.

---

**Note** Run this test when any major component change is made to the module (for example, any microcircuit or converter change).

---

**Determining preselector peak DAC values**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Connect the RF section's rear panel 21.4 MHz OUT connector to the HP 70902A IF section's rear panel 21.4 MHz IN connector.
3. Set the mainframe line switch to ON.
4. Load and run Test 16. Microwave Image Rejection.
5. Refer to Chapter 3 for information about running the software.

The UUT and the microwave source are set to each reference frequency in the 1L-, 2L- and 4L+ bands. At each frequency the preselector peak value is read and stored.

**Measuring image response**

Connect the RF section's rear panel 21.4 MHz OUT connector to the RF INPUT of the spectrum analyzer.

The 21.4 MHz output of the UUT is measured and noted to establish a reference. The image response is then measured by the spectrum analyzer and the image rejection is calculated and compared to test limits.



**Test 17. EMIM Image Rejection**

The purpose of this verification test is to measure the ability of the RF section to reject a signal applied to the front panel EXT MIXER IF input connector; these signals produce image responses. It is intended to guarantee module performance in accordance with the system image responses specification when used with external mixers.

---

**Note**                    If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Measuring reference level**

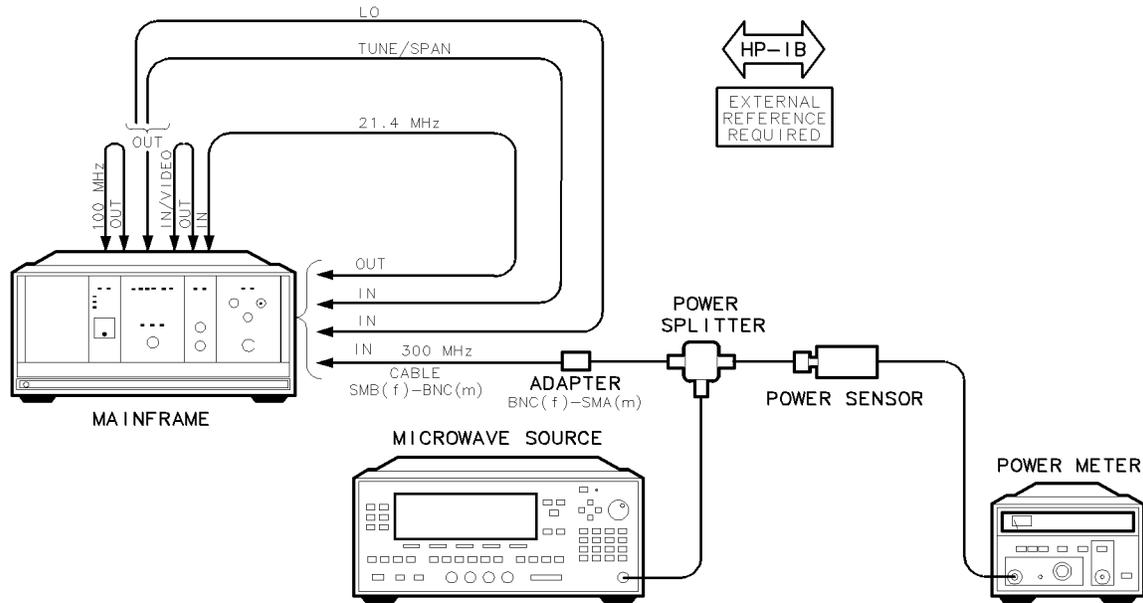
1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 17. EMIM Image Rejection. Refer to Chapter 3 for information about running the software.

When performing this verification test, the spectrum analyzer measures the 21.4 MHz output of the RF section; the level is noted and checked against the setup test limits. If these limits are not met, the test is halted and indicates failure.

**Measuring image response**

The power meter measures and notes the RF input power of the UUT. After the microwave source tunes to 278.6 MHz, the RF input power of the UUT is again measured with the power meter and noted. From these measurements, the image response performance is calculated.

Test 18. 2nd Converter Startup



sca6q

Figure 6-21. Equipment Setup for Test 18. 2nd Converter Startup

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz-300 kHz) .....	HP 70902A IF section
External reference ....	Refer to "External Frequency Reference Requirements" in Chapter 4.
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (2 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1200 50Ω SMA(m) to BNC(f)

**Test 18. 2nd Converter Startup**

The purpose of this verification test is to verify the range of reference input frequency and amplitude over which the second converter PLL will acquire lock with turn on and operate properly.

---

**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

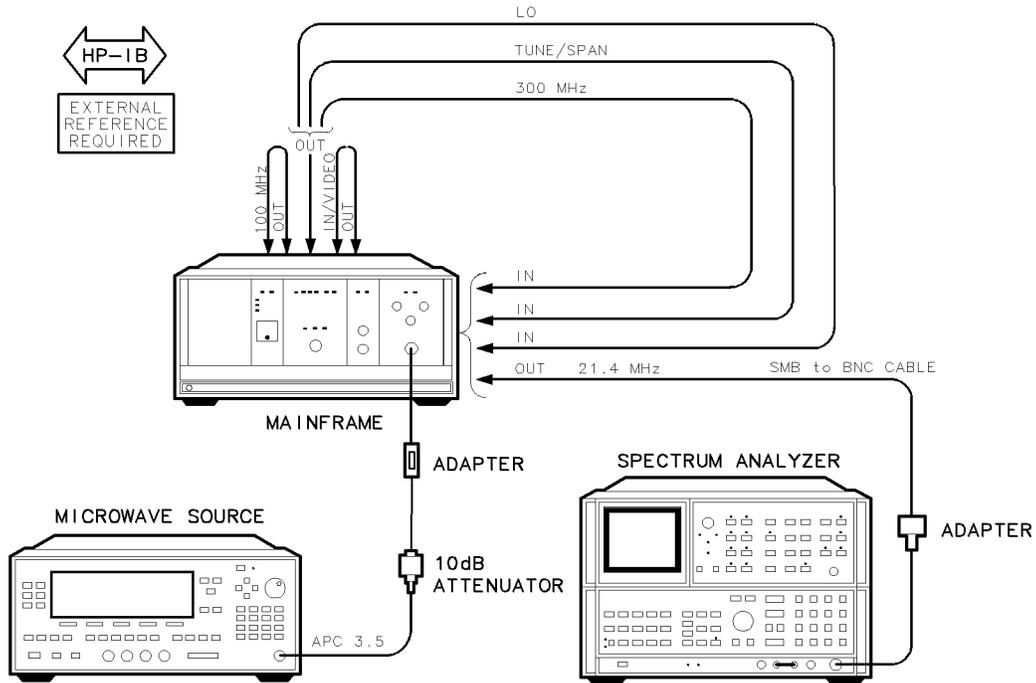
---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 18. 2nd Converter Startup. Refer to Chapter 3 for information about running the software.

When performing this verification test, the power meter reads the power level and the microwave source adjusts until the power reading equals a specified reference amplitude. The DUT is checked for 2nd Converter unlocked condition; this is repeated for five different amplitudes and five different frequency offsets from 300 MHz.

The RF section switches from the 1L– to the 1H– band and the diagnostics are checked for a 2nd converter unlocked condition.

Test 19. Microwave Residual Responses



sca60

Figure 6-22. Equipment Setup for Test 19. Microwave Residual Responses

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Termination .....	HP 909D Option 011 50Ω 3.5 mm(f) termination
Attenuator .....	HP 8493C Option 010 coaxial fixed attenuator
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)
Adapter .....	HP 1250-1158 50Ω SMA(f) to SMA(f)

**Test 19. Microwave Residual Responses**

The purpose of this verification test is to measure residual responses.

Residual responses appear in a system as false signals when no signal is applied to the RF INPUT connector. These residual responses are due to mixing of various harmonics of the LO that are internal to the HP 70909A RF section or by 300 MHz and its harmonics.

---

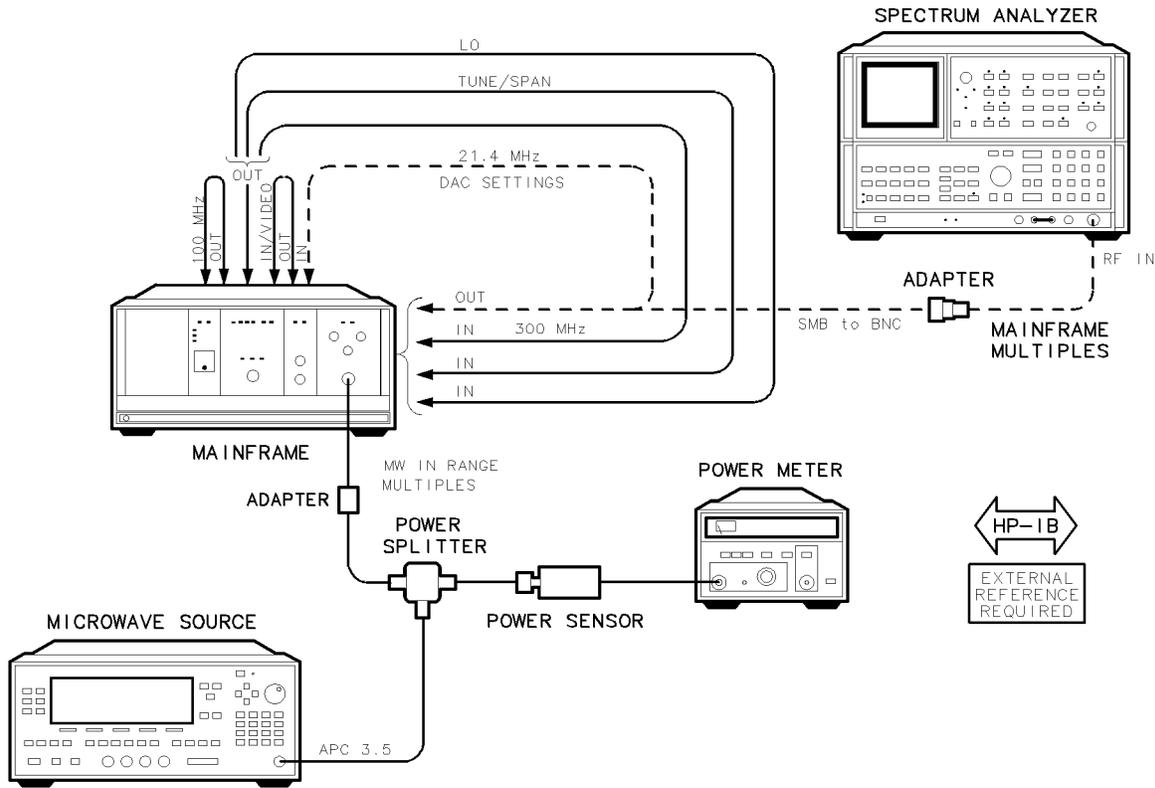
**Note** If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 19. Microwave Residual Responses. Refer to Chapter 3 for information about running the software.

When performing this verification test, the band to be tested in the RF section is activated and the LO is set to the frequency needed to tune the RF section to center frequency. The spectrum analyzer measures the amplitude at the 21.4 MHz IF output with 10 dB attenuation. The HP 8566B spectrum analyzer attenuation is changed to 0 dB and an attenuation correction factor is calculated. Measured values are corrected by subtracting the attenuator correction factor to yield the residual response. The result is compared with test limits.

Test 20. Microwave In-Range Multiples



sca6p

Figure 6-23. Equipment Setup for Test 20. Microwave In-Range Multiples

Test Equipment

Preferred Model Numbers

Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Spectrum analyzer .....	HP 8566B spectrum analyzer
Microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Power meter .....	HP 436A power meter
Power sensor .....	HP 8485A APC-3.5 mm(m) power sensor
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable .....	HP 85680-60093 123 cm 50Ω BNC(m) to SMB(f)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter .....	HP 1250-1476 precision 50Ω N(m) to BNC(f)

**Test 20. Microwave In-Range Multiples**

The purpose of this verification test is to measure multiples in and out of band. Multiples are created when an applied RF signal, which the spectrum analyzer is not tuned to, mixes with an LO harmonic. Out of range multiples created by RF signals greater than 26.5 GHz are not currently covered in this test.

---

**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

**Characterizing the source and connectors**

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Connect the 21.4 MHz output of the RF section to the HP 8566B spectrum analyzer's 21.4 MHz IF input.
3. Set the mainframe line switch to ON.
4. Load and run Test 20. Microwave In-Range Multiples. Refer to Chapter 3 for information about running the software.

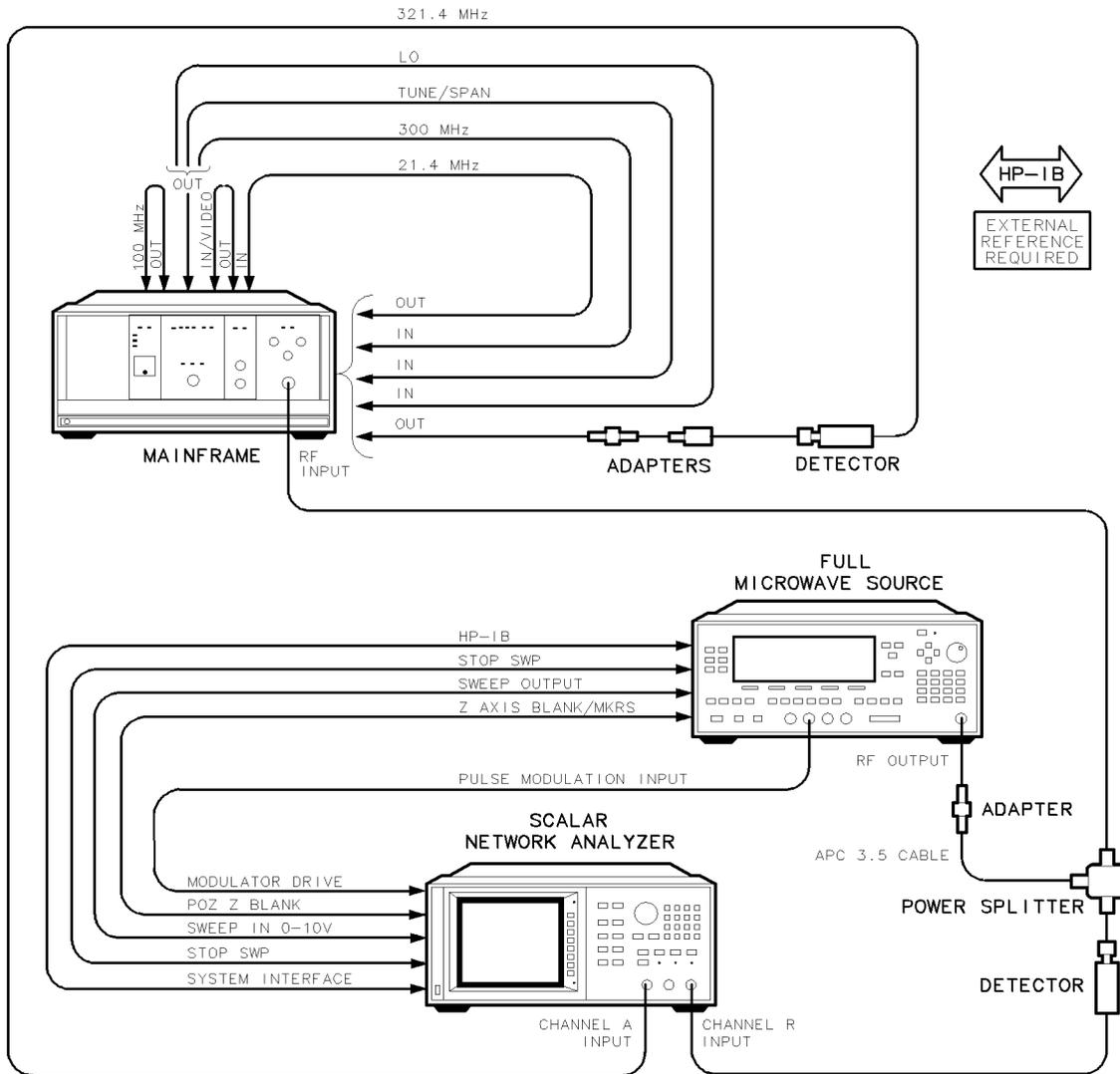
The calibration portion of the test characterizes the microwave source, cable, and power splitter so that the power level at the RF input of the UUT is known.

**Measuring in-range multiples**

In the measurement portion, the HP 8566B spectrum analyzer measures the 21.4 MHz IF output of the UUT. The RF output of the microwave source is set to a frequency that will generate a multiple response. The amplitude of the 21.4 MHz IF output is again measured and this level is subtracted from the previous measurement. The result is the uncorrected multiple response. The correction factor for the power meter reading is also determined. The actual multiple response is calculated by subtracting the power meter correction from the uncorrected multiple response.

Test 21. 321.4 MHz IF Output Bandwidth - HP 70910A Only

Test 21. 321.4 MHz IF Output Bandwidth - HP 70910A Only



SCB30

Figure 6-24. Equipment Setup for Test 21. 321.4 MHz IF Output Bandwidth

**Test 21. 321.4 MHz IF Output Bandwidth - HP 70910A Only**

<b>Test Equipment</b>	<b>Preferred Model Numbers</b>
Controller .....	HP 9000 Series 300 controller
Mainframe .....	HP 70001A mainframe
Local oscillator source .....	HP 70900A/B local oscillator source
IF section (RBW 10 Hz–300 kHz) .....	HP 70902A IF section
External reference ....	Refer to “External Frequency Reference Requirements” in Chapter 4.
Full microwave source .....	HP 83630A/B Option 001 and 008 synthesized sweeper
Scaler network analyzer .....	HP 8757D scalar network analyzer
Detectors (2 required) .....	HP 85025B detector
Power splitter .....	HP 11667B power splitter
Cable .....	HP 5061-9038 520 mm SMA(m) to SMA(m)
Cable (3 required) .....	HP 8120-5022 365 mm SMB(f) to SMB(f)
Cable (2 required) .....	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (4 required) .....	HP 8120-1840 122 cm 50Ω coaxial BNC(m) to BNC(m)
Cable .....	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable .....	HP 10833D 0.5 meter HP-IB cable
Adapter .....	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter .....	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter .....	HP 1250-0672 50Ω SMB(f) to SMB(f)

The purpose of this verification test is to measure the 3 dB bandwidth of the HP 70910A RF section’s rear panel 321.4 MHz OUT. It can be performed on HP 70909A RF section as a troubleshooting aid, but the test limits for minimum bandwidth do not apply.

---

**Note**            If this test fails, refer to “Verification Test Problems” in Chapter 7 for the troubleshooting instructions related to this test.

---

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 21. 321.4 MHz IF Output Bandwidth. Refer to Chapter 3 for information about running the software.

When performing this verification test, the HP 70910A RF section is set to the 1H–, 1L–, 2L–, or 4L+ Bands in preselected and bypass modes.

For preselected bandwidth measurement, the RF section and the microwave source center frequencies are set to YTF frequency. The widest 3 dB bandwidth is measured to avoid measuring passband ripple.

For bypass bandwidth measurement, the RF section and the microwave source center frequencies are set to bypass frequency.

## Troubleshooting

---

### Overview    In this chapter you will learn about:

- Preparing a static-safe work station
  - What to do with power-on problems, adjustment problems, and verification test problems
  - Detailed circuit descriptions for various assemblies that may aid in troubleshooting
  - Which adjustments and verification tests have to be run to ensure proper operation after an assembly has been repaired, replaced, or adjusted
  - An overall block diagram of the HP 70909A or HP 70910A RF section
- 

This chapter prepares you for troubleshooting your RF section. You will learn how to prepare a static-safe work station that is used during servicing. Then, you will learn how to resolve power-on problems, adjustment problems, and verification test problems. Finally, you'll learn in-depth circuit troubleshooting as well as which adjustments and verification tests have to be run to ensure proper operation after an assembly has been repaired, replaced, or adjusted.

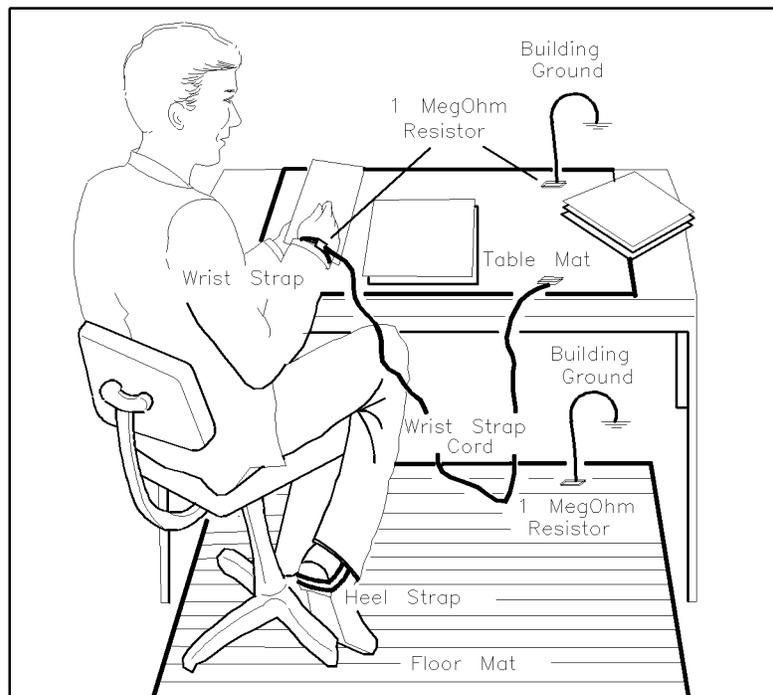
Preparing a Static-Safe Work Station .....	7-2
Power-On Failures .....	7-4
Error Messages .....	7-13
Adjustment Problems .....	7-17
Verification Test Problems .....	7-23
Troubleshooting the A2 RF First Converter .....	7-30
Troubleshooting the A5, A7, A8, A9 Second Converter .....	7-31
Troubleshooting the A6 Programmable Gain Amplifier .....	7-34
Troubleshooting the A10 Last Converter .....	7-36
Troubleshooting the A11 5 dB Step Attenuator .....	7-38
Troubleshooting the A12 RF Switch/A15 RF Switch and A21 Pin Switch/Diplexer .....	7-39
Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver .....	7-40
Troubleshooting the A16 Preamp/Mixer .....	7-43
Troubleshooting the A18 LO Leveling Amplifier .....	7-44
Troubleshooting the A20 Controller .....	7-45
Performing Related Adjustments and Verification Tests .....	7-48
Utilities Menu .....	7-51
Overall Block Diagram of HP 70909A or HP 70910A RF section .....	7-53

## Preparing a Static-Safe Work Station

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-safe work station.

Figure 7-1 shows an example of a static-safe work station. Two types of ESD protection are shown:

- a conductive table mat and wrist strap combination
- a conductive floor mat and heel strap combination



ESDPARTS

**Figure 7-1. Static-Safe Work Station**

These two types of ESD protection must be used together. Refer to Table 7-1 for a list of static-safe accessories and their HP part numbers.

- CAUTION**
- Do not touch the edge-connector contacts or trace surfaces with bare hands. Always handle board assemblies by the edges.
  - Do not use erasers to clean the edge-connector contacts. Erasers generate static electricity and degrade the electrical quality of the contacts by removing the thin gold plating.
  - Do not use paper of any kind to clean the edge-connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

## Reducing ESD Damage

To help reduce the amount of ESD damage that occurs during testing and servicing use the following guidelines:

- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from a piece of equipment.

Use a resistor-isolated wrist strap that is connected to the HP 70000 Series modular spectrum analyzer system mainframe's chassis. If you do not have a resistor-isolated wrist strap, touch the chassis frequently to equalize any static charge.

- Before connecting any coaxial cable to an instrument connector for the first time each day, *momentarily* short the center and outer conductors of the cable together.
- Handle all PC board assemblies and electronic components only at static-safe work stations.
- Store or transport PC board assemblies and electronic components in static-shielding containers.
- PC board assembly edge-connector contacts may be cleaned by using a lintfree cloth with a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. This procedure should be performed at a static-safe work station.

## Static-Safe ESD Accessories

**Table 7-1. Static-Safe ESD Accessories**

HP Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 m (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0865	Ground wire, 4.6 m (15 ft)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1367	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1308	ESD heel-strap (reusable 6 to 12 months).
Order the above by calling HP DIRECT at (800) 538-8787 or through any Hewlett-Packard Sales and Service Office.	

## Power-On Failures

Each time the HP 70000 Series modular spectrum analyzer system is turned on, the system runs through an initializing routine (power-on self test) during which the front panel STATUS LEDs on each module flash on momentarily and then turn off.

The display also executes a power-on self-test when power is applied. If the test fails, the display terminates the sequence and displays an error on the screen in large block letters. One of the instrument functions tested is the ability of the display section to communicate on the system bus (HP-MSIB). The results of the test can be determined by examining the system state area located in the upper-left corner of the display screen.

The following conditions for the display section should exist after the power-on self-test:

- The HP-MSIB fault indicator should be off.
- The display's fan noise will be scarcely noticeable.

If the system passes the power-on self test, the green MEASURE LED on the local oscillator module begins blinking on and off (triggered by the system sweep), and the ACT LED on each active module's front panel is turned on when a module is communicated with.

### **Catastrophic problems during power on may cause any of the following indications:**

- a blank display on an HP 70004A color display
- a VOLT/TEMP, CURRENT, or I/O CHECK LED on the HP 70001A mainframe
- modules may flash their own ERR LED at a 1 Hz rate
- modules or mainframes may not respond at all (due to lack of power)

---

**Note**            If you have multiple MMS mainframes, repeat the following procedure for each MMS mainframe.

---

To isolate a problem to a specific MMS display, mainframe, or module:

1. Turn power off to all HP 70001A mainframes.
2. Disconnect all HP-MSIB cables from the HP 70001A mainframe.

Each HP 70001A mainframe should be isolated from the rest of the system.

3. Turn power on to the HP 70001A mainframe being tested.
4. Check that you have power to the HP 70001A mainframe.

You should be able to hear the fan or feel the air flow from the fan if the HP 70001A mainframe is operating. All error LEDs on the HP 70001A mainframe should be off.

Refer to the following sections for further details related to:

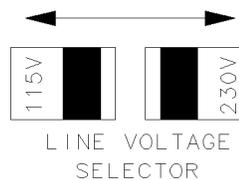
Display Problems .....	7-5
Mainframe Problems .....	7-9
Communication Problems on the HP-MSIB I/O .....	7-10
Error Messages .....	7-13
Adjustment Problems .....	7-17
Verification Test Problems .....	7-23

## Display Problems

### If the display is blank or distorted

To solve this problem:

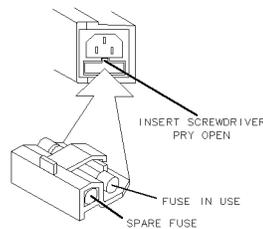
1. Check that the HP 70000 Series modular spectrum analyzer system display and mainframe are plugged into the proper ac line voltage.
2. Check that the line socket has ac line voltage.
3. Check that the line voltage selector switch is set to the correct voltage for the ac line voltage being used. The line voltage selector switch is located on the left side of the HP 70004A color display, on the bottom of the HP 70001A mainframe, or on the rear panel of the HP 70206A system graphics display.



lineselect

**Figure 7-2. Line Voltage Selector**

4. Check the line fuse on the display or the mainframe to ensure that it is not damaged. The line fuse is located inside the power-cord receptacle housing on the rear of the display and mainframe. Also included in this housing is a spare fuse. The fuse is a 5 by 20 mm fuse rated at 6.3 A, 250 V (HP part number 2110-0703). This line fuse can be used with both 120 V and 230 V line voltage.



fuses

**Figure 7-3. Line Fuse Removal and Replacement**

5. Verify that the intensity is turned on.
6. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Display Problems

### If one of the display's fault indicators is on

The display has three fault indicators and problems external to the display can cause the indicators to turn on:

- An HP-MSIB indicator on the upper-left corner of the front panel.
- A steady red E appears in the system state region located in the upper-left corner of the HP 70004A color display screen.
- A red battery-low indicator next to the RAM memory card access slot.

### The display's HP-MSIB fault indicator is on

An external HP 70001A mainframe is enabling the reset line because the HP-MSIB loop is incomplete.

The HP 70004A color display has an HP-MSIB system fault indicator in the upper-left corner of the front panel. This indicator applies to the I/O backplane and all modules in the system, not just the display system; the HP-MSIB indicator should be OFF indicating normal operation. This circuitry senses the readiness of the external HP-MSIB. If the HP-MSIB indicator light is on, HP-MSIB communications are inhibited and the condition must be cleared before the display will operate.

The HP-MSIB indicator light will be on if one of the following conditions is true:

- The external HP-MSIB loop is incomplete.

Check that both ends of all HP-MSIB cables are securely connected.

If more than one mainframe is used, or if other elements are connected to the HP-MSIB, all cables must be connected; otherwise, the HP-MSIB will not operate. If a single mainframe with no external elements is used, there should be no HP-MSIB cables connected to the external HP-MSIB connectors of that mainframe, although a single cable looped from the input connector to the output connector will allow the mainframe to operate.

- Not all the elements on the external HP-MSIB loop have the power turned on.

Verify that the power is on to the display, all mainframes, and stand-alone instruments on the external HP-MSIB.

To isolate the problem:

- Disconnect both HP-MSIB cables from the display rear panel. Is the HP-MSIB indicator light still on?

**NO** The problem is either with the cables or an element that was connected to the display with the cables.

Loop each cable (one at a time) from the display HP-MSIB IN to OUT connectors. If the HP-MSIB indicator comes on, that cable has probably failed. If the light does not come on for any of the cables, then an element connected with these cables is faulty. If an element is determined to be at fault, contact your nearest Hewlett-Packard sales and service office for repair.

**YES** The HP 70004A color display is probably faulty. Contact your nearest Hewlett-Packard sales and service office for repair.

### The display has a red "E" on in the upper-left corner

An error is being reported by an MMS master module or the display.

If any master module fails the power-on self test, it establishes an HP-MSIB link with the HP 70004A color display and triggers a red E to appear in the system state region located in the upper-left corner of the HP 70004A color display screen.

This E is the same as the red LED marked “ERR” on other HP 70000 Series modules. Its purpose is to indicate an error detected by one of the master modules on HP-MSIB ROW 0 of the address map.

To view the errors causing this problem:

1. Press **DISPLAY** **REPORT ERRORS**.

For additional information, refer to the documentation for the module that is reporting the error.

### The display has a RAM memory card battery-low indicator light on

The display has a RAM memory card battery-low fault indicator near the memory-card slot in the lower-right corner of front panel.

- The battery-low indicator will indicate on if the battery voltage is too low. The battery-low indicator will be off if there is no RAM memory card in the slot or if a one-time-programmable ROM memory card is being used.

### If you need to run display confidence tests

The Display Tests are the display diagnostic and adjustment routines. The Display Tests screen is accessed by pressing **DISPLAY** **Misc** **display tests**.

<b>T A</b>	13:29:50 09 07 1989	<b>DISP</b>
Main		CONFID TEST
Hard Copy		KEY TEST
Mass Storage		KNOB TEST
Adjust Color		TUMBLE FIGURES
Config Display		
Address Map		test pattern
Misc		service modes

Figure 7-4. **display tests** Menu Keys

**Display Problems**

**Confidence Test ( CONFID TEST Menu Key)**

Initiate the Display Confidence Test by pressing the CONFID TEST menu key. The Confidence Test checks the operation of roughly 90% of the display. If no fault is found, 6001 confidence test passed appears in the lower-left corner of the screen. If a fault is found, 6008 confidence test failed is displayed.

To run the Display Confidence Test:

1. Press (DISPLAY) Misc display tests CONFID TEST.

If an error is detected, contact your nearest Hewlett-Packard service office.

If the display passes the Confidence Test, and the display screen shows no visible distortion, there is a high level of probability that the display is functioning correctly. If the display fails the Confidence Test, it attempts to write E (error) in the display status block.

If the HP-MSIB is working, any error messages produced by the Confidence Test can be viewed by pressing the (DISPLAY) and REPORT ERRORS.

At power-on, a set of tests that is different from the Confidence Test is run. The set of tests run at power-on includes tests for the HP-MSIB capability of the display. The display indicates whether any of these tests fail, but does not indicate if they pass. An HP-MSIB failure is indicated by a blinking E (error) indicator in the status block.



**Figure 7-5. Confidence Test**

There are additional tests (Key Test, Knob Test, Tumble Figures, Test Pattern, Display ID) that can be run on the display for both mechanical and electrical checks. For further information on how to run these additional tests, refer to the HP 70004A Color Display User's Guide.

## Mainframe Problems

### **If the I/O error on the mainframe is on (with HP-MSIB cables disconnected):**

This indicates a problem with the HP 70001A mainframe. For additional information, refer to the service guide for the MMS mainframe.

### **If the fan is not operating, VOLT/TEMP LED is on, CURRENT LED is on, or the display is blank**

This indicates either the HP 70001A mainframe is faulty or one of the MMS modules is preventing it from operating.

---

**CAUTION** When removing or installing MMS modules, the power to the HP 70001A mainframe must be off. Do not remove or install modules with power applied to the HP 70001A mainframe.

---

To solve this problem:

1. Remove the modules one at a time to determine what instrument is causing the problem.
2. If after removing all MMS modules from the mainframe and the problem is still occurring, this indicates a problem with the HP 70001A mainframe. For additional information, refer to the service guide for the HP 70001A mainframe.

### **If there are no problem indications after all HP 70001A mainframes have been checked:**

If the HP 70001A mainframe appears to function correctly with the fan operating and there are no error LEDs with the HP-MSIB cables disconnected, then:

- one of the HP-MSIB cables was not seated fully
- one of the HP-MSIB cables is faulty
- the HP 70001A mainframe is unable to communicate on the HP-MSIB

For additional information, refer to “Communication Problems on the HP-MSIB I/O”.

---

## Communication Problems on the HP-MSIB I/O

---

- Notes**
- All references to HP 70001A mainframes also include MMS stand-alone instruments that operate on the external HP-MSIB.
  - For additional troubleshooting procedures that are not covered in this document, refer to the documentation supplied with each module.
- 

### Preliminary checks

- Check that HP-MSIB communications are working.

To determine if HP-MSIB communications are working:

1. Turn on power to the HP 70000 Series modular spectrum analyzer system.
2. Press **DISPLAY** **Address Map**.
3. Verify that the HP-MSIB address map contains all of the addressable MMS modules in your system. You may need to scroll the address map to view the complete system.

- Check that the HP-MSIB loop is complete.

If more than one HP 70001A mainframe is connected to the HP-MSIB, all HP-MSIB cables must be connected forming a loop with the “HP-MSIB OUT” of one HP 70001A mainframe connected to the “HP-MSIB IN” of the next HP 70001A mainframe, otherwise the HP-MSIB cannot operate.

- Check that all ends of all HP-MSIB cables are seated securely so that the external HP-MSIB loop is complete.

Do not over-tighten the attaching screws during this process.

### To check HP-MSIB cables

Because the HP-MSIB loop is connected in series, any one of the HP-MSIB cables or HP 70001A mainframes could disrupt HP-MSIB communication. If any one of the HP-MSIB cables or HP 70001A mainframes in a system are defective, the entire HP-MSIB loop will not work.

- Check that the mainframes and cables are operating correctly.

1. Set up a minimum system with only the HP 70004A color display and a single MMS mainframe.

If this single HP 70001A mainframe system works, then you can check the HP-MSIB cables (70800X cables) by inserting them in series between the HP 70001A mainframe and display, and then restarting the HP 70004A color display.

2. If the single HP 70001A mainframe system and all of the HP-MSIB cables are good, then substitute the remaining HP 70001A mainframes (each time forming a single HP 70001A mainframe system) until the problem is located.

If the problem has not been located, verify that the system does not have modules with duplicate HP-MSIB addresses. For additional information, refer to the section, “Duplicate HP-MSIB Addresses”.

- If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Duplicate HP-MSIB Addresses

---

**CAUTION** When removing or installing MMS modules, the power to the HP 70001A mainframe must be off. Do not remove or install modules with power applied to the HP 70001A mainframe.

---

All modules in an MMS system must have a unique HP-MSIB row and column address. If two or more modules have the same HP-MSIB address, the HP-MSIB bus can not be used for communication. When you find the conflicting MMS modules, you will have to change one of them to a new HP-MSIB address that is unoccupied. You will also need to reevaluate the system that the module was in to see if the system addressing is correct for that system.

**Table 7-2. Default HP-MSIB Address Map**

	Column 18	Column 19	Column 20
<b>Row 7</b>	blank	HP 70310	blank
<b>Row 6</b>	RF sections <sup>1</sup>	HP 70300	HP 70620 or HP 70621 <sup>2</sup>
<b>Row 5</b>	HP 70907	HP 70301	blank
<b>Row 4</b>	HP 70903	blank	HP 70810 Option 850
<b>Row 3</b>	HP 70911	HP 70620 or HP 70621 <sup>3</sup>	HP 70810
<b>Row 2</b>	HP 70700	HP 70600 or HP 70601	blank
<b>Row 1</b>	HP 70902	blank	blank
<b>Row 0</b>	HP 70900	blank	blank

<sup>1</sup> This includes: HP 70904A RF section, HP 70905A/B RF section, HP 70906A/B RF section, HP 70908A RF section, HP 70909A or HP 70910A RF section.

<sup>2</sup> When preamplifying the lightwave section's input signal.

<sup>3</sup> When preamplifying the preselector's or RF section's input signal.

For more information about addressing criteria, refer to *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* or *HP 71910P Wide-Bandwidth Receiver User's Guide*.

## Communication Problems on the HP-MSIB I/O

### Isolating a duplicate HP-MSIB addressing conflict

There is an HP-MSIB address conflict between two or more MMS modules or a single MMS module and the HP 70004A color display.

A typical symptom of modules having duplicate HP-MSIB addresses is when the ERR LED on one or more modules is flashing at a 1 Hz rate.

To solve this problem:

1. If front panel keys are still responding, check the address map to see that all modules are located in their designated coordinates.
2. If front panel keys are not responding and the address map cannot be checked, power-down the system.
  - a. Note the HP-MSIB address of the HP 70004A color display.
  - b. Remove all MMS modules and compare each module's HP-MSIB address against every other MMS module in the system and to the HP-MSIB address of the HP 70004A color display.
  - c. Assure that each MMS module and the HP 70004A color display have a unique HP-MSIB address.

The HP-MSIB address is usually set using address switches (DIP switches) that are accessed through the cover of each module and the rear panel of the HP 70004A color display.
  - d. Change the HP-MSIB address on one or more of any conflicting MMS modules or the HP 70004A color display so that each module's HP-MSIB address and the address of the HP 70004A color display is unique.
3. If your system contains more than one mainframe, check that the HP-MSIB cables are connected such that two cable connections are made to each mainframe. If these cable connections look correct and the problem persists, you may try replacing the HP-MSIB cables with new ones.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

## Error Messages

### If operating errors messages (2000–2999) occur

Operating errors are generated when a module in the HP 70000 Series modular spectrum analyzer system is not used properly. These errors can occur at any time, but are most common during remote operation. Operating errors range from 2000–2999 and are reported by the HP 70900B local oscillator source.

**2001    Illegal cmd**

Refer to the description for **illegal parameter** below.

**2002    illegal parameter**

The remote command sent over the bus or executed as part of a DLP was not a legal remote command.

To solve this problem:

1. Use the “DEBUG ON OFF” key to turn on debug mode and determine exactly which command is generating the error.
2. Check for missing terminators and the proper number of parameters.
3. Verify that delimited strings are properly ended.
4. Refer to the programming manual for proper syntax.

**2006    Param out of range**

A change was made to an instrument setting that was beyond the capabilities of the hardware. This could be remote, DLP, or front panel changes.

To solve this problem:

1. For remote applications use “DEBUG ON OFF” key, to verify which setting caused the error.
2. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for descriptions of hardware capability.

**2009    Protocol error**

This is an internal error due to illegal communication caused by hardware failure.

To solve this problem:

1. Document all details possible that preceded the error.
2. Obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Error Messages

### If hardware error messages (7000–7999) occur

Hardware errors are generated when a module in the HP 70000 Series modular spectrum analyzer system is not working properly. These errors can occur at any time. Hardware errors range from 7000–7999.

One or more of the following hardware error messages may appear on your system display:

#### 7000 **ROM check error**

This hardware error occurs when the programmed checksum of U5, on the A20 controller, does not agree with the computed checksum.

To solve this problem:

1. Replace A20U14 and A20U15.
2. If the problem remains, refer to troubleshooting the A20 controller.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

#### 7002 **1st LO unlevelled**

This hardware error occurs when the signal of the 1st local oscillator is unlevelled.

To solve this problem:

1. Check the rear-panel 1ST LO IN connection.
2. Verify that the power into the A18 LO leveling amplifier is between +7 dBm and +15 dBm.
3. If correct, refer to troubleshooting the A18 LO leveling amplifier.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

#### 7003 **2nd LO unlocked**

This hardware error occurs when the signal of the 2nd LO phase-locked loop circuitry is not phase-locked to the 300 MHz reference signal.

To solve this problem:

1. Check the rear-panel 300 MHz IN connection.
2. Perform the A5, A7, A8, A9 second converter adjustments.
3. If the problem remains, refer to troubleshooting the A5, A7, A8, A9 second converter.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

#### 7004 **300 MHz error**

This hardware error occurs when the power is low at the input of the A10 last converter’s 300 MHz amplifier.

To solve this problem:

1. Check the rear-panel 300 MHz IN connection.
2. If the problem remains, refer to troubleshooting the A10 last converter.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**7047 RAM failure**

This hardware error occurs when the A20 controller has detected one or more defective RAM devices.

To solve this problem:

1. Replace A20U2 and A20U3.
2. If the problem remains, refer to troubleshooting the A20 controller.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**7077 YTF drive error**

This hardware error occurs when the A20 controller has detected an incorrect drive voltage on the A19 power supply/YTF driver.

To solve this problem:

1. Perform the YTF adjustment procedure.
2. If the problem remains, refer to troubleshooting the A19 power supply/YTF driver.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**7078 Tune + Span error**

This hardware error occurs when the Tune+Span voltage on the A19 power supply/YTF driver is low.

To solve this problem:

1. Check the rear-panel TUNE SPAN connection.
2. If the problem remains, refer to troubleshooting the A19 power supply/YTF driver.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**7079 EEPROM check error**

This hardware error occurs when the A20 controller has determined that the EEPROM memory is invalid. Either the EEPROM is defective or the data in the EEPROM must be reloaded. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

To solve this problem:

1. Change A20U5.
2. Refer to troubleshooting the A20 controller.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**Error Messages****If system error messages (9000-9999) occur****9000 HP 70900B RAM CORRUPT**

This error indicates that the HP 70900B local oscillator source RAM has been corrupted. This can be caused by multiple DLPs downloaded which may have variables or functions with the same name.

---

**Note** Performing this procedure will clear the HP 70900B local oscillator source's RAM. During this process, the HP 70900B local oscillator source's serial number will be lost along with any DLPs that were stored in RAM.

---

To solve this problem:

1. Remove the HP 70900B local oscillator source and set the TEST/NORMAL DIP switch to TEST.
2. Insert the HP 70900B local oscillator source back into the mainframe and turn power on.
3. Wait approximately 30 seconds with power turned on.
4. Remove the HP 70900B local oscillator source and set the TEST/NORMAL DIP switch to back to NORMAL.
5. Insert the HP 70900B local oscillator source back into the mainframe and turn power on.
6. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

---

## Adjustment Problems

The following troubleshooting instructions are grouped according to module adjustment procedures. If the RF section fails an adjustment, look up the procedure in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment.

### If Adjustment 01. Power Supply Voltage Checks Fails

To solve this problem:

1. Refer to “Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver”.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Adjustment 02. 1st LO Power Fails

When the LO is leveled, a green LED (A19DS1) is on. If the A18 LO leveling amplifier becomes unlevelled during the adjustment, the adjustment stops and you are informed that an unlevelled condition exists.

To solve this problem:

1. If unleveling occurs, the procedure stops and you may adjust the LO level DAC value to try to achieve a leveled condition.
2. If the A18 LO leveling amplifier cannot meet low power requirements for the 1L– and 2L– bands, then you may change A19R72 from 133 K $\Omega$  to 196 K $\Omega$ .
3. If the A18 LO leveling amplifier cannot be adjusted high enough in the 4L+ band, then you may change A19R72 from 196 K $\Omega$  to 133 K $\Omega$ .
4. Try cycling power to the UUT to clear a 1st LO Unlevelled error 7002.

This error may get latched if you are using an external microwave source as the 1st LO IN to the UUT.

5. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Adjustment Problems

### If the 2nd Converter Fails

If any of the 2nd converter adjustments fail, use the following procedures to determine the cause of the malfunction.

---

**CAUTION** The 2nd converter contains extremely static-sensitive components. Before proceeding, refer to “Preparing a Static-Safe Work Station”.

---

**Note**

- If the cover of the 2nd converter is removed to make an adjustment, replace it with a 2nd converter test cover (HP 5022-1150) during testing to assure consistent ground connection and proper converter alignment.
- 2nd converter adjustments must be run in the order specified; do not run them out of order.

---

The 2nd converter adjustments consist of the following:

- Adjustment 03.01 VCO Tune-Line Voltage
- Adjustment 03.02 VCO Frequency and Amplitude
- Adjustment 03.03 2nd Converter LO Feedthrough
- Adjustment 03.04 Sampler DC IF Out
- Adjustment 03.05 Sampler AC IF Out
- Adjustment 03.06 Search Oscillator Duty Cycle and Period
- Adjustment 03.07 Search Oscillator Square Wave Min/Max
- Adjustment 03.08 Search Oscillator VCO Tune Line
- Adjustment 03.09 Phase Lock
- Adjustment 03.10 VCO Tune Range
- Adjustment 03.11 Lock Range Measurement
- Adjustment 03.12 Bandpass Filter and VCO Tune Range Final
- Adjustment 03.13 Mixer Bias

### If Adjustment 03.01 VCO Tune-Line Voltage Fails

To solve this problem:

1. If A9R7 cannot be adjusted for  $-5$  V, troubleshoot the A9 2nd LO PLL assembly.
2. Verify that the A5 VCO/sampler is not loading down the tune line.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.02 VCO Frequency and Amplitude Fails**

To solve this problem: **LO Frequency**

1. If the VCO will not oscillate, check for an open electrical connection between the A9 2nd LO PLL assembly and the A5 VCO/sampler. The connection is made using spring contacts underneath the A9 2nd LO PLL assembly. If the electrical connection is good, the voltage at A9J4 pin 2 (Vcc) will measure about +10.7 V and the voltage at A9J4 pin 3 (Vee) will measure about -2.7 V. The assembly must be disassembled to verify the contacts for A9J4 pin 1 and A9J2 pin 3.
2. If the VCO oscillates but cannot reach 3.3 GHz from the low side, loosen all of the screws holding the cavity block. Push the whole cavity block towards the front and bottom of the module, and tighten the screws while holding it in that position. The positioning of the LO cavity to the antenna probe inside the cavity is critical. Loosening the A5 VCO/sampler, rotating it CCW, and re-tightening it may fix this problem.
3. If the VCO oscillates and then jumps to some other unadjustable frequency at a lower amplitude, center the LO adjust slug and cycle the power. This problem usually occurs when the VCO is being adjusted away from 3.3 GHz. It is possible to have the bandpass filter adjustment slugs in so far that they short out against the bottom of the casting.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**LO Amplitude**

1. If there are two or fewer threads showing on the SMA (2ND LO OUT) connector, replace the A5 VCO/sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.03 2nd Converter LO Feedthrough Fails**

To solve this problem:

1. If the 3.3 GHz feedthrough cannot be adjusted within specification, the failure is most likely either C2 feedthrough cap, A8 321.4 MHz matching network, or A7 2nd mixer.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.04 Sampler DC IF Out Fails**

To solve this problem:

1. Replace the A5 VCO/sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.05 Sampler AC IF Out Fails**

To solve this problem:

1. Replace the A5 VCO/sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Adjustment Problems

### If Adjustment 03.06 Search Oscillator Duty Cycle and Period Fails

To solve this problem:

1. If the search oscillator does not work, the problem is most likely A9U1.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Adjustment 03.07 Search Oscillator Square Wave Min/Max Fails

To solve this problem:

1. Perform the Adjustment 03.06 Search Oscillator Duty Cycle and Period.
2. If this test still fails after adjusting the search oscillator, the problem is probably on the A9 2nd LO PLL assembly, or there is too much ac and/or dc coming out of the A5 VCO/sampler. (Refer to Adjustment 03.03 2nd Converter LO Feedthrough and Adjustment 03.04 Sampler DC IF Out.)
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Adjustment 03.08 Search Oscillator VCO Tune Line Fails

To solve this problem:

1. If A2R6 cannot be adjusted to stop the search oscillator, there is probably a problem with the phase-lock loop; perform Adjustment 03.09 Phase Lock.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Adjustment 03.09 Phase Lock Fails

To solve this problem:

1. Remove the 300 MHz cable at A9J1.
2. Set the spectrum analyzer to a center frequency of 300 MHz and a span of 1 MHz. The 3.3 GHz oscillator will now be enabled.
3. Connect an oscilloscope to A9TP1.
4. There should be a pulse with a 35% to 70% duty cycle with the peaks about  $\pm 9.5$  V.
5. If the pulse is missing, troubleshoot the search oscillator and perform the Adjustment 03.13 Mixer Bias.
6. If the pulse is present, phase-lock amplifier A9U1 is operating correctly.
7. Measure the voltage at A9J4 pin 3. It should read about  $-2.7$  V.
8. If it is near 0 V, check A9J2 pin 4 (VCO Control) for a TTL high. A TTL high indicates that the oscillator is enabled.
9. If the voltage on pin 4 is not a TTL high, the VCO control signal is not correct. Troubleshoot the A20 controller.
10. Verify that there is a 300 MHz, 3 dBm signal going into A9J1. If the signal is low or not present, refer to troubleshooting the A10 last converter.
11. Connect a spectrum analyzer with a 1:1 probe to A9J4 pin 4 and look for a 300 MHz,  $-10$  dBm signal. The power level will depend upon the type of probe used.
12. If there is no 300 MHz signal present, troubleshoot the A9 2nd LO PLL assembly.
13. If the 300 MHz signal is present, the A5 VCO/sampler is probably bad or the spring contacts are open. Refer to the VCO Frequency Failure and VCO Amplitude Failure paragraphs for comments about the spring contacts.
14. If no failure is found, perform the Adjustment 03.02 VCO Frequency and Amplitude.
15. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.10 VCO Tune Range Fails**

To solve this problem:

1. If the VCO cannot be adjusted to remain locked at the extremes, and if the Adjustment 03.08 Search Oscillator VCO Tune Line passes, there is a problem on the A5 VCO/sampler.
2. If the Adjustment 03.08 Search Oscillator VCO Tune Line fails, there is a problem with the A9 2nd LO PLL assembly.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.11 Lock Range Measurement Fails**

To solve this problem:

1. Perform Adjustment 03.10 VCO Tune Range.
2. If the adjustment cannot be performed, refer to the preceding VCO tune range preliminary adjustment failure information procedure and “Troubleshooting the A5, A7, A8, A9 Second Converter”.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.12 Bandpass Filter and VCO Tune Range Final Fails**

To solve this problem:

1. If the bandpass response is greatly over-coupled or under-coupled and cannot be adjusted flat, the IF input SMA connector may be screwed in too far or not far enough.
2. Feedthrough capacitor C1 (from the mixing diode to the matching network) can affect the bandpass shape. It is usually manifest by a skewing of the bandpass to one side or another, and higher-than-normal conversion loss.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 03.13 Mixer Bias Fails**

To solve this problem:

1. Perform Adjustment 03.02 VCO Frequency and Amplitude.
2. If Adjustment 03.02 VCO Frequency and Amplitude passes, the problem is probably either feedthrough capacitor C1 or the A7 2nd mixer diode. The A8 321.4 MHz matching assembly can also cause this to fail.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Adjustment 04. Last Converter Alignment Fails**

To solve this problem:

1. Refer to “Troubleshooting the A10 Last Converter” and use a spectrum analyzer with an active probe to measure the gains and losses.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

## Adjustment Problems

### If Adjustment 05. PGA Calibration Fails

To solve this problem:

1. Use a power meter to measure the input and output power levels of the A6 programmable gain amplifier. (For appropriate levels and how to dither, refer to “Troubleshooting the A6 Programmable Gain Amplifier”.)
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Adjustment 06. YTF Alignment Fails

To solve this problem:

1. Refer to “Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver” and verify the correct biasing and gain or conversion loss through the YTF using a power meter.  
This test is dependent on the HP 70900B local oscillator source TUNE/SPAN output voltage adjustment.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

---

## Verification Test Problems

The following troubleshooting instructions are grouped according to module verification tests. If the RF section fails a verification test, look up the test in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment.

### If Test 01. Switch Repeatability Fails (HP 70910A only)

To solve this problem:

1. Verify that A12 RF switch and A15 RF switch are switching.
2. Verify +32 volts on A19J3, pins 8, 13, 14, and 21.
3. If the problem remains, refer to troubleshooting the A19 power supply/YTF driver block F.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Test 02. External Mixer Gain Calibration Fails

The A6 programmable gain amplifier is responsible for external mixer gain.

To solve this problem:

1. Perform the A6 programmable gain amplifier’s adjustment procedures.
2. If the problem remains, check the A10 last converter block A and B.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Test 03. Gain and Flatness Calibration Fails

Lowband, highband, or both could exhibit the following symptoms:

- low power
- high power
- power holes

To solve this problem:

1. Determine which band has a problem by using an external source tuned to a CW frequency located in the band in question and measure the amplitude using spectrum analyzer markers.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If you have lowband problems from 100 Hz through 2.9 GHz

If the signal exhibits low or high power in the lowband path, perform the following adjustments and tests. These adjustments and tests are run from module verification software.

Perform the following related adjustments:

- Adjustment 03. 2nd Converter Adjustments Menu
- Adjustment 04. Last Converter Alignment
- Adjustment 05. PGA Calibration

Perform the following related verification tests:

- All verification tests

If after completing the listed adjustments and tests, the problem may be at a frequency that is not being tested by the module verification software; if this occurs, perform the steps outlined under “Measuring amplitude of suspected CW signals”.

## Verification Test Problems

### If you have highband problems from 2.7 GHz through 26.5 GHz

If the signal exhibits low or high power in the highband path, perform the following adjustments and tests. These adjustments and tests are run from module verification software.

Perform the following related adjustments:

Adjustment 04. Last Converter Alignment

Adjustment 05. PGA Calibration

Adjustment 06. YTF Alignment

Perform the following related verification tests:

All verification tests

If after completing the listed adjustments and tests, the problem may be at a frequency that is not being tested by the module verification software; if this occurs, perform the steps outlined under “Measuring amplitude of suspected CW signals”.

### Measuring amplitude of suspected CW signals

1. Tune the spectrum analyzer to a suspected center frequency that has low amplitude.
2. Supply an external signal at that suspected center frequency to the RF input.
3. Verify that the power level of the displayed signal is close to the power level that is being inserted.
4. Gain and flatness problems may be caused by anything in the RF path. To troubleshoot a problem, refer to the block diagram and open up the path and measure conversion losses or gains using a power meter or spectrum analyzer. Refer to the troubleshooting section of each particular assembly for conversion loss or gain values.

### If Test 04. Flatness Below 50 MHz Fails

Failure indicates a problem in the path from the RF input through the A2 RF first converter to the REAR PANEL 21.4 MHz output.

To solve this problem:

1. Perform the A5, A7, A8, A9 second converter adjustments.
2. If the problem remains, refer to troubleshooting the A2 RF first converter and A10 last converter.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Test 05. Microwave Gain and Noise Figure Fails

Noise Figure failures may be caused by high conversion loss, high insertion loss, or the addition of noise to the signal.

To solve this problem:

1. If the 1H– band (100 Hz to 2.9 GHz) fails, check the conversion loss of A2 RF first converter.
2. If the conversion loss is good, then perform the A6 programmable gain amplifier adjustments.
3. If the failure occurs in the 1L– through the 4L+ bands (2.7 GHz to 26.5 GHz), perform the A14 YTF adjustments and the A6 programmable gain amplifier adjustments.
4. If all paths fail perform the A10 last converter adjustments.
5. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Test 06. External Mixer Noise Figure Fails**

Failure of this test and the failure of Test 05. Microwave Gain and Noise Figure indicates a problem in the A10 last converter circuitry.

To solve this problem:

1. Perform the A6 programmable gain amplifier's adjustment procedures.
2. Perform the A10 last converter's adjustment procedures.
3. If incorrect, refer to troubleshooting the A10 last converter.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 07. Microwave TOI Fails**

Failure indicates a problem in the A10 last converter, A5, A7, A8, A9 second converter, A16 preamp/mixer, or A6 programmable gain amplifier.

To solve this problem:

1. Check if the problem is in 1H– band.
2. Ensure A5, A7, A8, A9 second converter and A10 last converter bandpass filters are peaked up.
3. If the problem is in other bands, perform Adjustment 04. Last Converter Alignment, Adjustment 05. PGA Calibration, and Adjustment 06. YTF Alignment.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 08. Diagnostics Check Fails**

Failure of this test indicates that either one or more of the diagnostic detectors in the HP 70909A or HP 70910A RF section failed to operate properly, or the A20 controller is malfunctioning.

To solve this problem if the 300 MHz or 21.4 MHz detector fails:

1. Refer to "Troubleshooting the A10 Last Converter".
2. If the problem remains, refer to "Troubleshooting the A20 Controller".
3. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

To solve this problem if the 2nd Converter VCO fails:

1. Perform Adjustment 03. 2nd Converter Adjustments Menu.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

To solve this problem if the EEPROM PROTECTED fails:

1. Refer to "Troubleshooting the A20 Controller".
2. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

## Verification Test Problems

### If Test 09. Front Panel LEDs Check Fails

Failure indicates a problem in the A20 controller or A22 status.

To solve this problem:

1. Manually turn on the ACTIVE LED and verify operation.
  - a. Press **DISPLAY** **Address Map**.
  - b. Using the RPG knob, scroll the rectangle in the address map until the address of the HP 70909A or HP 70910A RF section is highlighted.  
  
Use **ADJUST ROW** to move the rectangle vertically.  
  
When the HP 70909A or HP 70910A RF section is highlighted, the ACTIVE front panel LED should be on.
2. Manually turn on the ERROR LED and verify operation.
  - a. Remove the 300 MHz 2nd LO cable from the rear of the HP 70909A or HP 70910A RF section.
3. If the LEDs are not functioning, check A20U4, A20J5, or A22 status.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Test 10. 21.4 MHz IF Output Response Fails

This test measures the DUT's 21.4 MHz output  $-3$  dB bandwidth.

To solve this problem:

1. Perform the A10 last converter's adjustment procedures.
2. If the problem remains, refer to troubleshooting the A10 last converter.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

### If Test 11. IF Emissions and Harmonics Fails

This test measures the presence of the 300 MHz at the DUT's rear panel 321.4 MHz OUT.

To solve this problem:

1. Perform the A10 last converter's adjustment procedures.
2. If the problem remains, refer to troubleshooting the A10 last converter.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “Contacting Hewlett-Packard for Servicing or Ordering Parts” in Chapter 1.)

**If Test 12. EMIM LO Out Power and Harmonics Fails**

For proper operation of external mixers, A18 LO leveling amplifier must maintain a minimum power of +14 dBm (from 0°C to 55°C) at the HP 70909A or HP 70910A RF section's front panel EXT MIXER LO output over the full range of LO frequencies. Additionally, harmonics of the LO signal must be kept at a minimum to minimize unwanted mixing products.

To solve this problem:

1. Perform the A18 LO leveling amplifier's adjustment procedures.
2. Check that the LO input signal is within the proper limits (+5 dBm to +15 dBm over the 3 GHz to 6.6 GHz range).
3. Check that the cable from the A18 LO leveling amplifier to the front panel is good and that the connectors are not damaged.
4. If the problem remains, refer to troubleshooting the A18 LO leveling amplifier.
5. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 13. 1st LO Out Power and Harmonics Fails**

The A18 LO leveling amplifier provides LO power to HP 70909A or HP 70910A RF section's rear panel 1ST LO OUT in order to daisy-chain other modules that require a 1st LO into the system. If this test fails, insufficient power to drive another module was measured at this connector.

To solve this problem:

1. Perform the A18 LO leveling amplifier's adjustment procedures.
2. Check that the LO input signal is within the proper limits (+5 dBm to +15 dBm over the 3 GHz to 6.6 GHz range).
3. Check that the cable from the LO leveling amplifier to the rear panel LO OUT is good and that the connectors are not damaged.
4. If the problem remains, refer to troubleshooting the A18 LO leveling amplifier.
5. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 14. TUNE + SPAN + PRESEL PEAK Output Fails**

Failure of this test indicates a problem with the signal at the HP 70909A or HP 70910A RF section's front panel EXT MIXER TUNE/SPAN output.

To solve this problem:

1. Perform Adjustment 06. YTF Alignment.
2. Check that the TUNE/SPAN input signal is correct.
3. If the problem remains, refer to troubleshooting the A19 power supply/YTF driver.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

## Verification Test Problems

### If Test 15. LO Input Amplitude Range Fails

This test measures the range over which the A18 LO leveling amplifier can properly deliver leveled LO output to the front and rear panels without becoming unlevelled. Failure of this test indicates that the A18 LO leveling amplifier has insufficient sensitivity to level the incoming LO signal.

To solve this problem:

1. Perform the A18 LO leveling amplifier's adjustment procedures.
2. If the problem remains, refer to troubleshooting the A18 LO leveling amplifier.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

### If Test 16. Microwave Image Rejection Fails

Image responses occur at twice the IF frequency. A failure of this test is most likely caused by the stopband response of filters in the signal path.

To solve this problem:

1. If the failure occurs at 42.8 MHz, it is due to the Adjustment 04. Last Converter Alignment.
2. If the failure occurs at 642.8 MHz, determine if the failure is occurring in lowband or highband, then refer to the block diagram.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

### If Test 17. EMIM Image Rejection Fails

Image responses occur at twice the IF frequency. This test measures the amplitude of the image response at 278.6 MHz or  $[321.4 \text{ MHz} - (2 \times 21.4 \text{ MHz})]$ . A failure of this test is most likely due to a filter stopband response.

To solve this problem:

1. Perform Adjustment 04. Last Converter Alignment.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

### If Test 18. 2nd Converter Startup Fails

In microwave bands, the A5, A7, A8, A9 second converter is normally off to prevent unwanted spurious responses at the IF output ports. In the heterodyne mixing band (1H-), the second converter must turn on in response to an enabling signal from the processor. This test toggles this enable line several times and tests whether or not the second converter starts. Failure indicates the second converter did not start each time in response to the enabling signal.

To solve this problem:

1. Check 2nd Converter adjustment.
2. Check A20U4 VCO control line. A TTL high turns on the 2nd Converter VCO.
3. If the problem remains, refer to troubleshooting the A5, A7, A8, A9 second converter.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 19. Microwave Residual Responses Fails**

Residuals are caused by internal oscillators and their harmonics combining with each other in the converters and generating signals that fall within the IF passband. Failures generally are caused by faulty isolators, excessive mismatch between converter stages, faulty or maladjusted IF bandpass filters in the A5, A7, A8, A9 second converter or A10 last converter blocks, or oscillators that are set at too high a power level.

To solve this problem:

1. Perform the A5, A7, A8, A9 second converter's and A10 last converter's adjustment procedures.
2. Check that all connectors are torqued properly.
3. Check for cracked solder joints in semi-rigid cables.
4. If the problem remains, refer to troubleshooting the A5, A7, A8, A9 second converter and A10 last converter assemblies.
5. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

**If Test 20. Microwave In-Range Multiples Fails**

A multiple response is when an input signal mixes with an internally generated IF signal or its harmonic other than what was intended. This response can be seen if it falls within the IF passband during a sweep. Failure of this test indicates that one of the filters in the A5, A7, A8, A9 second converter or A10 last converter assemblies or the preselector is not attenuating these unwanted mixing products sufficiently.

To solve this problem:

1. Check for loose or damaged semi-rigid cables.
2. Perform the Adjustment 03. 2nd Converter Adjustments Menu, Adjustment 04. Last Converter Alignment, and Adjustment 06. YTF Alignment.
3. If the problem remains, refer "Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver", "Troubleshooting the A5, A7, A8, A9 Second Converter", and "Troubleshooting the A10 Last Converter".
4. If necessary, obtain service from Hewlett-Packard. (Refer to "Contacting Hewlett-Packard for Servicing or Ordering Parts" in Chapter 1.)

---

## Troubleshooting the A2 RF First Converter

The A2 RF first converter up-converts the RF signal to a 3.6214 GHz IF. If you suspect a faulty A2 RF first converter, verify the RF and LO inputs are correct and measure the conversion loss. The maximum RF input to the A2 RF first converter (mixer) without causing damage to it, is +20 dBm.

<b>Conversion Loss</b>	
100 Hz to 2.0 GHz	8.0 dB
2.0 GHz to 2.9 GHz	9.25 dB
<b>LO Drive Power</b>	
Minimum	13.3 dBm
Maximum	14.7 dBm
<b>Flatness</b>	
100 Hz to 2.5 GHz	$\pm 1$ dB

---

## Troubleshooting the A5, A7, A8, A9 Second Converter

The five parts that make up the 2nd converter are the A5 VCO/sampler, A7 2nd mixer, A8 321.4 MHz matching assembly, A9 2nd LO PLL assembly, and 3.6 GHz cavity bandpass filter and oscillator.

The A5 VCO/sampler provides two functions: (1) varactor tuning for the 3.3 GHz local oscillator, and (2) sampler-phase detector for the 3.3 GHz oscillator.

The A8 321.4 MHz matching assembly provides the necessary loads to the output of the 2nd converter and the input of A11 5 dB step attenuator.

The A9 2nd LO PLL assembly provides two functions: (1) 300 MHz amplification for use as the sampling signal, and (2) 3.3 GHz oscillator frequency correction voltage.

Refer to the Adjustment 03.12 Bandpass Filter and VCO Tune Range Final for additional help.

---

**CAUTION** The A5 VCO/sampler, A7 2nd mixer, A8 321.4 MHz matching assembly, and A9 2nd LO PLL assembly are extremely static-sensitive. Before proceeding, refer to “Preparing a Static-Safe Work Station”.

---

---

**Note** If the cover of the 2nd converter is removed to make an adjustment, replace it with a 2nd converter test cover (HP 5022-1150) during testing to assure consistent ground connection and proper converter alignment.

---

### VCO Adjust

1. Turn on mainframe power.
2. Turn A9R6 (sampler offset adjustment) fully CW (clockwise).
3. Adjust A9R7 (tuning range adjustment) for  $-5.0$  V at A5J4-1 (VCO tune line).
4. Connect the HP 8566B spectrum analyzer RF INPUT to A8 321.4 IF OUT.
5. Adjust LO ADJ (VCO cavity tuning screw) for an IF output frequency of  $3300$  MHz  $\pm 1$  MHz.
6. If the oscillator will not adjust for an output frequency of  $3300$  MHz, perform the following steps.
  - Measure the VCO bias voltages at J4-2 and J4-3. They should be  $+10.4$  V and  $-2.7$  V, respectively. If J4-2 measures  $+12$  V or if J4-3 measures  $-12$  V, there may be no contact between the spring clips on the A5 and feedthroughs on the VCO feedthrough cover (HP 5086-1626).
  - Positioning of the bandpass filter relative to the antenna-probe screw can be critical. Typically, the casting should be as far as possible from the wall of the centerbody casting. To re-position the filter, loosen all screws in the bandpass casting. While holding the casting down and away from the top of the module, tighten all screws in a criss-cross pattern.
  - Positioning of the VCO/sampler board is also critical. To reposition, loosen the SMA connector nut and the two grounding screws. Typically the board is positioned toward the left corner and rotated CCW.
  - Verify that none of the bandpass filter tuning screws are screwed all the way in.
7. Connect the power meter to the 2nd LO auxiliary output SMA connector on the VCO cavity. Set the output power to  $-7.75$  dBm by turning the SMA connector in or out of the cavity housing. (This power level directly affects the SAMPLER AC IF OUTPUT.) This power level should be close to correct with two threads showing on the aux out coupling connector. If not, the failure is most likely a faulty oscillator transistor (TC131) or incorrect supply voltages at the oscillator circuit.
8. Tighten the SMA connector locknut; then tighten the set screw.

## Troubleshooting the A5, A7, A8, A9 Second Converter

### Sampler DC IF Output

1. Connect the semi-rigid cable between the 2nd LO AUX OUT and the SAMPLER input.
2. Connect the synthesizer RF output (300 MHz, 0 dBm) to the 300 MHz reference input on the DUT rear panel.
3. Connect the DVM between TP-2 and J4-4 to measure the sampler IF OUTPUT. The voltage should be no greater than  $\pm 50$  mVdc with the cable connected from the aux out.
4. Disconnect the DVM.

### Sampler AC IF Output

1. Connect the semi-rigid cable between the 2nd LO AUX OUT and the SAMPLER input.
2. Connect the oscilloscope (or DVM) between J4-4 and ground.
3. Peak the response on the oscilloscope by tuning the synthesizer from 299.9 MHz to 300.1 MHz. The AC IF OUTPUT should be  $\geq 196$  mV peak to peak. Check the power level at the 300 MHz Aux port (+2 to 8 dBm) and at the SRD driver amp (15 dBm). If these power levels are correct, the failure is most likely either a defective sampler or feedthrough J4-4.

### Search Oscillator Adjust

1. Connect the oscilloscope between A9TP1 and ground.
2. Set the reference frequency to 302 MHz.
3. Adjust R6 (sampler offset pot) for a 50% duty-cycle square wave at A9TP1. The square wave should switch between greater than +9.5 V and less than -9.5 volts.
4. Set the reference frequency to 298 MHz and check the duty cycle of the A9TP1 waveform. If the duty cycle is not 50%, repeat steps 2 through 4. If the search oscillator is not working, the failure is most likely A9U1 (phase-lock-loop amplifier).

### Search Oscillator Peak

1. Connect the oscilloscope between A9J4-1 and ground.
2. Adjust R7 (tune range pot) for a square wave peak between 0 and -2 Vdc.

### Phase Lock

1. Set the reference frequency to 300 MHz, and then verify 2nd LO phase lock.
2. Verify a stable -4 to -5 V at J4-1.

### VCO Tuning Range Preliminary

1. Connect the DVM between A9TP1 and ground.
2. Set the reference frequency to 300.6 MHz.
3. Adjust the VCO cavity adjustment screw (usually CCW) until the 2nd LO phase locks. The following are phase lock indicators: the green 2nd LO LOCKED LED on A10 last converter, a stable negative voltage (approximately -10 to -8 V) at A2TP1, a stable oscillator signal as viewed on the spectrum analyzer.
4. Set the reference frequency to 299.35 MHz.
5. Adjust R7 (usually CW) for 2nd LO phase lock. The DVM will indicate a positive voltage (6 to 9 V).
6. Repeat steps 2 through 5 until the 2nd LO remains locked at both reference frequencies without further adjustment of R7.

### Mixer Bias Check

1. Connect the DVM between A8TP1 and ground.
2. The mixer bias should be in the range of +0.6 to +1.3 V. If mixer bias is higher than +1.3 V, check the value of the 100 ohm resistor on A8. If the bias is lower than +.6 V, the failure is most likely a bad mixer or poor 2nd LO coupling to the mixer. If the bias is -0.6 to -1.3 V, the mixer diode is backwards, but this will not affect operation.

**Troubleshooting the A5, A7, A8, A9 Second Converter****Bandpass Filter Adjustment**

1. Adjustment 03. 2nd Converter Adjustments Menu requires a scalar network analyzer. (Refer to “Test Equipment Requirements” in Chapter 2 for a list of scalar network analyzers that can be used.) Run the Adjustment 03. 2nd Converter Adjustments Menu from the test list.
2. In wide span (100 MHz) the bandpass filter center frequency will be to the right of center screen on the network analyzer.
3. Turn A8L1 all the way out.
4. Tune IF ADJ 3 for a peak at center frequency.
5. Tune IF ADJ 2 for a dip at center frequency. Peaks on either side of the dip should be nearly the same amplitude.
6. Tune IF ADJ 1 for a peak and an overall well-shaped bandpass.
7. Adjust A8L1 for overall bandpass flatness and symmetry.
8. If the 3 dB bandwidth limits and flatness cannot be met, adjust the input coupling connector for more or less coupling. This will necessitate readjustment of IF ADJ 1, 2, and 3.

**VCO Tuning Range Final**

Repeat the adjustment steps found under Adjustment 03.10 VCO Tune Range.

## Troubleshooting the A6 Programmable Gain Amplifier

Prior to performing Adjustment 05. PGA Calibration, the following adjustments must have been completed successfully:

- Adjustment 02. 1st LO Power
- Adjustment 03. 2nd Converter Adjustments Menu
- Adjustment 04. Last Converter Alignment

The A6 programmable gain amplifier has 32 dB of gain in 0.1 dB steps. Simplified operation consists of A19U19 DAC controlling two pin diode pi-network attenuators on the A6 programmable gain amplifier and thus controlling the gain. The DAC values are stored in a look up table in A20U5 EEPROM. (For the location of the PROTECT/ENABLE switch location, refer to Figure 5-7.)

### (A) INPUT SELECTOR

The A6 programmable gain amplifier has three 321.4 MHz IF inputs. One from the second converter (A6J4), one from the A16 preamp/mixer (A6J3), and one from the front panel external mixer IF input (A6J2). A6U23 decoder selects which input the PGA uses. The decoder selection is done by S0 and S1 inputs which are provided by the A19 power supply/YTF driver. The truth table follows, using 0 as a TTL-low and 1 as a TTL-high.

S1	S0	Input
0	0	RF
0	1	$\mu$ W
1	0	mm (external mixer IF)

When the decoder selects the external mixer IF, it also turns on the bias for the external mixer IF amplifier. The outputs of the decoder are fed to four comparators that have a series pass transistor on their output.

### (F) SWITCHER

When the series-pass transistor (in Block A) is turned on, it provides forward (turn on) biasing for pin diodes CR8, CR9, and CR11 depending on which 321.4 MHz input is selected. If the transistor is turned off, it reverse biases (turns off) CR8, CR9, and CR11 and forward biases shunt pin diodes CR6, CR10, and CR12; again, this depends upon which input is being selected. The other outputs of the decoder are not used.

### (D,E,J) MM, $\mu$ W, RF INPUT AMP

Each of the IF 321.4 MHz inputs is amplified by a Monolithic Microwave Integrated Circuit (MMIC). Each of the following amplifiers have a gain of 12 dB with a Noise Figure of approximately 3.5 dB and a Third Order Intercept (TOI) of 18 dBm, referenced to the input. A6U8 amplifies the microwave input and A6U9 amplifies the RF input. All three inputs are amplified by A6U13 (second gain stage) and A6U7 (last gain stage).

### (D) MM INPUT AMP

The mm (external mixer IF) is first amplified 8 dB by Q6 and then MMICs, A6U10 and A6U11, both of which amplify the signal an additional 12 dB. The total mm gain is thus 32 dB with a 0.5 dB rolloff from 221 MHz to 421 MHz.

**Troubleshooting the A6 Programmable Gain Amplifier****(B,K,N) ATTENUATOR DRIVERS, FIRST and SECOND ATTENUATOR**

The Gain Control input, which is derived from the DAC on the A19 power supply/YTF driver, is divided and eventually converted to a current to bias the pin diodes in their linear region and thus attenuate the 321.4 MHz IF. Each attenuator provides between one and seventeen dB of attenuation. Each pin diode in the pi-network has its own voltage to current converter.

When the RF or uW input is selected, a 0 Volt signal applied to the Gain Control input results in a loss of 2 dB for the PGA. A 10 Volt input results in 30 dB gain for the PGA.

When the mm (external mixer IF) is selected, a 0 Volt signal applied to the Gain Control input results in a 16 dB gain for the PGA. A 10 Volt input results in a 48 dB gain for the PGA.

Through the spectrum analyzer front panel, you may force the HP 70909A or HP 70910A RF section to select a particular input.

To select the external mixer IF input:

1. Press State.
2. Select input, IN 2 EM 70910A or 70909A.

To select the RF input:

1. Enter a center frequency from 100 Hz to 2.7 GHz.
2. Enter 0 Hz span.

To select the microwave input:

1. Select a center frequency from 2.9 GHz to 26.5 GHz.
2. Enter 0 Hz span.

This may also be done using the Utilities available from the module verification software test menu.

To select the 1H- band using the Utilities:

1. Select the CHANGE DUT SETTING menu.
2. Select the SELECT 1H- BAND menu item.

You can select other bands from this menu if desired.

The Utilities may be used to DISPLAY EEPROM PGA DAC TABLE and set DAC values. When using this utility to change DAC values, be sure the start and stop frequencies you set the spectrum analyzer to do not cross bands. It is recommended that you use the HP 70900B local oscillator source 300 MHz calibrator as an input and 0 span.

---

## Troubleshooting the A10 Last Converter

The A10 last converter consists of two printed circuit assemblies. The A10A1 321.4 MHz band pass filter is connected to the A10 last converter with screws. All adjustments should be done with the A10 last converter cover on and with a non-metallic tweaker.

The primary function of the A10 last converter is to down-convert the 321.4 MHz, provided by the A6 programmable gain amplifier (PGA), to a 21.4 MHz IF that is used by the HP 70902A IF section or HP 70903A IF section.

The A10 last converter may cause Noise Figure or T.O.I. failures. This may be caused by a high conversion/insertion loss or excess noise. The amplifier's gain and the BPFs loss should be checked.

### (A) INPUT SPLITTER

The input 321.4 MHz signal has a bandwidth  $> 200$  MHz and enters the board through J1. It is then divided by splitter Z1 which has a 3 dB insertion loss.

### (B) EXTERNAL 321.4 MHz

One output port of the splitter is amplified approximately 9.5 dB and then routed to the module's rear panel.

### (C) INTERNAL 321.4 MHz

The other output port of the splitter is amplified approximately 6.5 dB. It is then filtered by the A10A1 321.4 MHz BPF.

### (D) 321.4 MHz BANDPASS FILTER BOARD

The A10A1 321.4 MHz BPF has a bandwidth of approximately 10 MHz with an insertion loss of 3.5 dB. A10C1, C2, C3, and C4 are adjusted to achieve the proper bandwidth shape and amplitude, which is a 4-pole butterworth filter. A10C5 is used to adjust the 278.6 MHz notch filter for minimum amplitude.

### (F) MIXER

Mixer A10Z2 down-converts the internal 321.4 MHz to a 21.4 MHz IF.

With a 0 dBm input signal at the rear panel 300 MHz in, the mixer LO should be approximately 18 dBm. The mixer has 6 dB of conversion loss.

### (I) 1ST LO AMP

The 300 MHz mixer local oscillator is provided by the HP 70900B local oscillator source and connects to the HP 70909A or HP 70910A RF section rear panel. The input 300 MHz, 0 dBm, is first amplified 12 dB by U1 and then split. U1 typically has a 3.5 dB noise figure and 18 dBm Third Order Intercept (T.O.I.), referenced to the input.

### (J) RESISTIVE SPLITTER and (M) 2ND CONVERTER LO BUFFER

One output of the resistive splitter's 300 MHz signal is buffered and used by the module's second converter.

### (K) 300 MHz BANDPASS FILTER

The other output of the splitter is filtered by a 300 MHz BPF, which is adjusted by C34.

### (L) 2ND LO AMP

The filtered 300 MHz signal is amplified 15 dB by Q19.

**(G) Diplexer**

The 21.4 MHz output of A10Z2 is passed through a diplexer. Signals < 60 MHz are routed to the 10.7 MHz notch filter (L18 and C52). Signals > 60 MHz are terminated in 50 ohms in the other leg of the diplexer.

**(E) 21.4 MHz AMP WITH TEMPERATURE COMPENSATION**

The 21.4 MHz IF is then amplified 8.5 dB by a temperature compensated amplifier. As the temperature increases, thermistors (RT1 and RT2) resistance decreases causing more current to flow through pin diode CR4. This causes the pin diode ac resistance to decrease and thus increases the gain of Q21. The amplifier gain changes 0.02 dB per degree Celsius change.

**(H) 21.4 MHz STEP GAIN AMP**

The final 21.4 MHz amplifier has a gain of either 3.5 dB or 13.5 dB depending on whether the 10 dB step gain is turned on. When the 10 dB step gain is turned on, comparator U4B turns on Q15 which switches in R69 and R76. This increases the gain of Q13 by 10 dB. The gain is adjustable with R76. Conversely, when the 10 dB step gain is turned off, comparator U4A turns off Q16.

**(N) SERVICE DETECTOR**

There are also two peak detectors on the A10 last converter. One checks for the presence of the input 300 MHz and the other checks for a 21.4 MHz output. If either signal doesn't have the proper amplitude, it will trip comparator U5A or U5B and an error will be sent to the A20 controller.

## Troubleshooting the A11 5 dB Step Attenuator

This assembly is a four-section 65 dB attenuator with 5 dB steps. It includes 5 dB, 10 dB, 20 dB, and 30 dB stages. The attenuator switching logic is provided by the A20 controller to the A19 power supply/YTF driver. A19 J10 supplies the logic to switch the attenuator along with the supply voltage. The following truth table may assist in troubleshooting the attenuator. The levels are being measured on U35.

**Table 7-3. A11 5 dB Step Attenuator Logic**

Attenuator Setting	Pin 2 0 dB	Pin 1 10 dB	Pin 6 0 dB	Pin 5 5 dB	Pin 8 0 dB	Pin 9 20 dB	Pin 10 0 dB	Pin 11 30 dB
0 dB	0 V	5 V	0 V	5 V	0 V	5 V	0 V	5 V
5 dB	0 V	5 V	5 V	0 V	0 V	5 V	0 V	5 V
10 dB	5 V	0 V	0 V	5 V	0 V	5 V	0 V	5 V
20 dB	0 V	5 V	0 V	5 V	5 V	0 V	0 V	5 V
30 dB	0 V	5 V	0 V	5 V	0 V	5 V	5 V	0 V
40 dB	5 V	0 V	0 V	5 V	0 V	5 V	5 V	0 V
50 dB	0 V	5 V	0 V	5 V	5 V	0 V	5 V	0 V
60 dB	5 V	0 V	0 V	5 V	5 V	0 V	5 V	0 V
65 dB	5 V	0 V	5 V	0 V	5 V	0 V	5 V	0 V

The active condition to switch the attenuator stage is when the logic voltage is a TTL low or 0 volts. For example, to turn on the 65 dB stage, U35 pins 1, 5, 9, and 11 are all low. This corresponds to the 10 dB, 5 dB, 20 dB, and 30 dB stages being on, totaling 65 dB of attenuation.

A19J10 also supplies the +32 volts to switch the attenuator.

## Troubleshooting the A12 RF Switch/A15 RF Switch and A21 Pin Switch/Diplexer

The A12 RF switch/A15 RF switch and A21 pin switch/diplexer troubleshooting has been grouped together because they are closely related.

- The A21 pin switch/diplexer routes the A11 5 dB step attenuator output to the first converter for RF input frequencies from 100 Hz to 2.9 GHz, 1H- band. For RF input frequencies from 2.7 GHz to 26.5 GHz, 1L- band and above, the switch routes the signal to the YTF or to A12 RF switch in the HP 70910A RF section.
- The A19 power supply/YTF driver provides the bias for switching A21 pin switch/diplexer. For lowband operation, the bias is approximately +14 Vdc, while highband operation is approximately -14 Vdc bias.
- The maximum insertion loss for all input frequencies is 2.5 dB.
- If the input signal isn't being routed properly check the biasing while changing the center frequency (via the front panel) between lowband and highband. If you are experiencing gain and flatness failures, due to the switch, then use a spectrum analyzer or power meter to measure the insertion loss at the frequency of failure.
- The HP 70909A RF section is always preselected, while the HP 70910A RF section has the option to bypass the YTF. The A12 RF switch and A15 RF switch (which are only available in the HP 70910A RF section) are used to route the input signal to the YTF or bypass it.
- The A12 RF switch/A15 RF switch are both HP 33312CAs which have less than 0.35 dB insertion loss at 4 GHz and less than 1 dB at 26.5 GHz. The switch common drive pin is biased by +32 Vdc and is supplied by the A19 power supply/YTF driver. This bias should always be present at the switch common terminal. Switching occurs when drive pin 1 or 2 is grounded or a negative voltage is applied; this is accomplished by A19U26 transistor array. When switching occurs, the input to U26 is a positive TTL pulse. The collector output of U26 is pulled to Vcc, +32 Vdc, when static. When the transistor is turned on by the input pulse, the output collector goes to 0 Vdc. This latches the switch solenoid and causes it to switch.
- To generate correction factors for the bypass mode rolloff, run Test 03. Gain and Flatness Calibration; the correction factors are stored in EEROM. If the test fails the bypass mode, verify the switches are being switched.

To verify the switches are being switched:

1. Using the front panel, press the **State** softkey.
2. Press **pre-select** and **PRESEL On/Off**.

You should be able to hear the switches switch. If you aren't sure that the switches are switching properly, check the solenoid drive pins with an oscilloscope and turn the preselection on and off.

If the switch is switching, then use a spectrum analyzer or power meter to measure the insertion loss.

## Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver

The A14 YTF and A19 power supply/YTF driver troubleshooting has been grouped together because they are closely related.

- The HP 70909A or HP 70910A RF section use a YIG Tuned Filter (YTF) for preselection from 2.7 GHz to 26.5 GHz. The HP 70910A RF section has a coaxial switch to bypass the YTF, while the HP 70909A RF section is always preselected. The modules use different YTFs, with the HP 70910A RF section having a wider bandwidth (BW) for use in the HP 71910A wide-bandwidth receiver. The HP 70910A RF section YTF BW is > 36 MHz while the HP 70909A RF section YTF BW is approximately 27 MHz.

### Simplified operation:

The Tune + Span signal from the HP 70900B local oscillator source is a 1.5 Vdc/GHz of the LO frequency and is used by the A19 power supply/YTF driver to tune the YTF. The A19 power supply/YTF driver adds some correction to the Tune + Span signal through five DACS on the board. This ensures the YTF is peaked and is tracking the input signal properly. The YTF is tuned one IF (321.4 MHz) away from the LO due to the mixing equation:

$$RF = nLO \pm IF$$

Where  $n$  is the harmonic of the LO.

### Detailed operation:

The YTF resonant frequency is changed by varying a DC magnetic field applied to the YIG spheres. A19 power supply/YTF driver outputs, J23 and J24, provide a varying current to the YTF coil that is dependent upon the spectrum analyzer center frequency. Typical tuning of the YTF is 75 MHz/mA. The YTF also employs a heater to minimize temperature dependence of the resonant frequency. The YTF heater is biased with a  $\pm 15$  Vdc. If you measure across the + and – heater terminals on the YTF you should measure +30 Vdc. When the YTF is disconnected from A19J3, the coil resistance should measure approximately 68 ohms. The YTF also has an insertion loss of 6.5 dB to 7 dB dependent on frequency.

- The five DACs used on the A19 power supply/YTF driver are AD7528 dual 8-bit DACS. A19U2 is used for Offset and Preselector Peaking. A19U7 is a Delay Compensation and Gain Adjust. A19U12 is used for the 20 GHz breakpoint. The truth table for the DACs are:

DAC A/DAC B (Pin 6)	CS (Pin 15)	WR (Pin 16)	DAC A Out (Pin 2)	DAC B Out (Pin 20)
Low	Low	Low	Write	Hold
High	Low	Low	Hold	Write
X <sup>1</sup>	High	X	Hold	Hold
X	X	High	Hold	Hold

<sup>1</sup> Each X in this table means that it does not matter (don't care) whether the pin is high or low.

## Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver

- During YTF alignment, the software sets the DACs to the following values while a coarse adjustment is done with A19R38 and A19R39.

Delay	40
20 GHz Breakpoint	60
Preselector Peak	128
Offset	128
Gain	128

- The spectrum analyzer is set for a center frequency of 4.6786 GHz and a network analyzer is used to measure the center frequency of the YTF passband. The operator adjusts A19R38 until the YTF passband is within  $\pm 5$  MHz of 4.6786 GHz. The spectrum analyzer is then set for a center frequency of 20.3214 GHz. The operator adjusts A19R39 until the YTF passband is within  $\pm 5$  MHz of 20.3214 GHz. These adjustments are interactive.
- The test then uses a DVM to monitor the front panel Tune + Span output and steps the spectrum analyzer center frequency and optimizes all DAC values. The test does not have hard specifications and will allow the operator to store DAC values that fall out of the normal statistical range. Sound judgement should be used in storing these values as you may be masking a potential future failure;  $\pm 10$  DAC values within minimum and maximum would be considered sound judgement. During adjustments the software will display a troubleshoot softkey. When the softkey is pressed, the software will pause to allow manual troubleshooting with the current test equipment settings.
- The DAC values may be dithered for troubleshooting purposes using the Utilities available from the module verification software test menu. In the Utilities main menu, press "CHANGE DUT RAM/DAC CONTENTS". This brings up a submenu to select what DAC value you want to change.

```
-----
Menu for:  CHANGE DUT RAM/DAC CONTENTS
-----
```

```
EXIT THIS MENU
CHANGE OFFSET DAC VALUE
CHANGE GAIN DAC VALUE
CHANGE DELAY DAC VALUE
CHANGE PEAK DAC VALUE
CHANGE BREAK POINT DAC VALUE
CHANGE PGA DAC VALUE
CHANGE PGA GAIN
```

- If you encounter a power hole, check the YTF input and output cabling. A hairline crack in the semi-rigid cable will cause a power hole. Torque the cables to 10 inch pounds. Do not over torque the input and output cables as this could damage the YTF internal connections and cause a power hole in the 16 GHz to 18 GHz range.

**Troubleshooting the A14 YTF and A19 Power Supply/YTF Driver****Power Supply Troubleshooting**

The A19 power supply/YTF driver contains the power supplies and driver circuits for the various assemblies of the module.

The following power supplies are provided by A19 power supply/YTF driver J8:

- J8-1 +15 Vdc
- J8-3 +5 Vdc (Green LED DS2 should be on)
- J8-5 +8 Vdc
- J8-7 +7 Vdc
- J8-9 -15 Vdc
- J8-11 +39 Vdc
- J8-13 ground

If all the power supplies are down, check F1. If it is open, replace it. Turn on the power of the HP 70000 Series modular measurement system. If the supply voltages are incorrect or if the fuse still blows at power up, disconnect J2, J3, J4, and J10.

If the power supply comes up, then one of the other assemblies is causing the fuse to open. Turn off the power of the HP 70000 Series modular measurement system, replace one cable at a time, and then turn the power back on. Continue to replace one cable at a time while checking F1. When the problem shows, troubleshoot the faulty assembly serviced by the cable.

If F1 continues to open with the above connections removed, turn off the power and check the resistance of the filter capacitors.

If F1 does not open, and all the above power supplies are missing, check J1 pins 1 and 2 for 24 average Vdc at 40 kHz. If all of the supplies except the +39 Vdc are out of specification, check U31 pin 2. Pin 2 should be 2.5 Vdc and is used as a reference for comparators U28, U29, and U30.

## Troubleshooting the A16 Preamp/Mixer

- The A16 preamp/mixer microcircuit is used when the modules input frequency is from 2.7 GHz (in 1L– band) to 26.5 GHz. The RF input signal enters the microcircuit via J1 and is preamplified prior to being harmonically mixed and down converted to a 321.4 MHz IF. The preamplifier needs a +5 Vdc bias that is provided by A19 power supply/YTF driver.
- The A16 preamp/mixer contains pin diode switches that are biased to route the 3 GHz to 6.6 GHz LO signal. If the 1H- band is selected, the LO input (J4) is routed out J3 to the 1st converter. If an external mixer is being used, the LO is routed out J2 to the front panel LO out. The Out1 Bias and the Out2 Bias control the pin diode switching and are supplied by the A19 power supply/YTF driver. The following table shows the biasing and the appropriate LO output.

Out1 Bias	Out2 Bias	LO output
+14 Vdc	+13 Vdc	Used by A16 preamp/mixer
–13 Vdc	0 Vdc	A2 RF first converter
+14 Vdc	–13 Vdc	Front panel LO

- For the mixer portion of the microcircuit to function, a bias is provided by the A19 power supply/YTF driver. The bias is +2.5 Vdc for the 1L– (2.7 GHz to 6.2 GHz) and 0 Vdc for the other bands. The mixer needs an input LO power from +10 dBm to +17 dBm with the harmonics being below –15 dBc.
- Typical conversion losses for the A16 preamp/mixer are as follows.

1L– (2.7 GHz to 6.2 GHz)	3.5 dB (loss) to a 1 dB (gain)
2L– (6.0 GHz to 12.8 GHz)	6 dB (loss) to 0 dB (no loss)
4L+ (12.6 GHz to 22.0 GHz)	14 dB (loss) to 6.5 dB (loss)
4L+ (22.0 GHz to 26.5 GHz)	15 dB (loss) to 7.5 dB (loss)

- The mixer IF output passes through an internal low pass filter prior to exiting the microcircuit at J5. Typical IF output flatness is  $\pm 0.25$  dB from 221.4 MHz to 421.4 MHz.
- Failures of TOI, Noise Figure, and Frequency Response power holes between 15 GHz and 24 GHz may be caused by the A16 preamp/mixer. The A16 preamp/mixer conversion loss should be checked using a spectrum analyzer or power meter. If the A16 preamp/mixer is defective, the whole assembly needs to be replaced since it is a microcircuit.

---

## Troubleshooting the A18 LO Leveling Amplifier

The A18 LO leveling amplifier receives its biasing from the A19 power supply/YTF driver through J3.

- J3-1 gate bias is adjusted to the voltage printed on the A18 LO leveling amplifier.
- J3-5 and J3-6 supply +7 Vdc to the A18 LO leveling amplifier.
- J3-20 supplies +5 Vdc to A18 LO leveling amplifier.

A19U12 is a dual DAC that adjusts the A18 LO leveling amplifier output power. Pin 6 controls which DAC is used. A logic “1” on this pin selects the A18 LO leveling amplifier power out adjust DAC. A binary “0” on the input (D0-D7) produces the minimum power out of the A18 LO leveling amplifier. Conversely a binary “255” on D0-D7 produces a maximum power out.

## Troubleshooting the A20 Controller

### (A) CPU BLOCK

The A20 controller uses a Motorola 68000 microprocessor operating at 8 MHz. The clock is generated by a 16 MHz oscillator, U10, and is divided by 2 before it is used by the microprocessor. Pin 1 on U10 must be a TTL high to enable the oscillator.

The microprocessor can also be halted if LRESET and LHALT are TTL lows. Both of these signals need to be TTL highs for the microprocessor to function properly.

### (B) MEMORY

The module firmware resides in One Time Programmable (OTP) ROMs, U14 and U15, each containing 128 KBytes. There are also two SRAMs, U2 and U3, each of these contain 32 KBytes. The SRAM is not backed up by battery, so the contents are lost when the module is powered down. An Electrically Erasable ROM (EEPROM), U5, contains 8 KBytes of alignment data. U5 has a Write/Protect switch that must be in the Write position to store data into the EEPROM. If the switch is in the Write position a warning "6000 EAROM Unprotected" is displayed.

### (C) DECODER

Under normal operation, U6, a Programmable Array Logic (PAL) device executes a state machine that generates the Data Acknowledge (DTACK). When DTACK is a TTL low, this tells the microprocessor that the instruction has completed successfully. If DTACK remains a TTL high, the A20 controller will lock up waiting for DTACK to go low.

If an interrupt to the microprocessor is generated by U13, the PAL is told to keep DTACK high. There are seven possible interrupt states, but only three are used. A TTL high on pins 25, 26, and 27 of the microprocessor represent a level zero interrupt. This means no interrupt is pending. A level six interrupt is a system timer interrupt and a level five interrupt is an MSIB interrupt; a level six interrupt is higher precedence.

### (D) MSIB

The A20 controller contains the module's MSIB circuitry. Each module has a unique row and column address that is determined by S1. An open switch will be at a TTL high. A 9-bit transceiver, U9, is used to read data and write data onto the MSIB bus. If U9 pins 1 and 11 are TTL lows then data is read from the bus. If U9 pins 13 and 14 are TTL lows then data is written to the external bus. The MSIB circuit is tested at power up by the firmware and if it fails, the front-panel error LED will flash. This may be caused by an address conflict with another module. U8 is a custom MSIB integrated circuit that handshakes with the mainframe for bus time. When bus time is required, U8 asserts Request to Send (RTS) low. When bus time is granted, the mainframe asserts Clear to Send (CTS) low and provides the MSIBCLK at pin 25. A TTL low on pin 36 will reset the MSIB.

To check MSIB communication from the display to the module:

1. Press the **DISPLAY** softkey.
2. Press the **Address Map** softkey.
3. Scroll the RPG to the column where the module is residing.
4. Press the **ADJUST ROW** softkey.
5. Using the arrow keys, move the green rectangle up to the row where the module is located.

The front panel green ACT LED should lite.

**Troubleshooting the A20 Controller****(E) CONTROL LATCH**

Other functions of the A20 controller include turning on and off the 10 dB step gain, the YTF filter, and the active and error front panel LEDs. These control signals are latched by U4. These functions may be checked by configuring the module into a spectrum analyzer or using the Utilities available from the module verification software test menu.

Select Utilities, then CHANGE DUT SETTINGS. From this menu you may turn the YTF on or off, or select the 1H- band to check the VCO detector.

```
-----
Menu for:  CHANGE DUT SETTINGS
-----
```

```
EXIT THIS MENU
PRESET FRONT END
PERFORM SELF TEST ON FRONT END
SELECT BYPASS PATH
SELECT PRESELECTOR PATH
SELECT 1H- BAND
SELECT 1L- BAND
SELECT 2L- BAND
SELECT 4L+ BAND
SELECT mm BAND
SET YTF DRIVE FILTER ON
SET YTF DRIVE FILTER OFF
SEND HYSTERESIS PULSE
SEND PREPARE TO SWEEP
```

**(F) POWER SUPPLY**

The  $\pm 12$  Vdc supplies each have a green LED, DS1 and DS2 respectively. Don't be fooled into thinking the power supplies are okay just because the LEDs are on. When they are lit, a voltage is present, but it may not be the full  $\pm 12$  Vdc.

**(G) DIAGNOSTIC DETECTORS**

The A20 controller monitors four detectors, 21.4 MHz present, 300 MHz present, EEPROM protected, and the second converter VCO locked. The VCO is only used in the 1H- band (100 Hz to 2.9 GHz). When the VCO is locked, green LED DS3 will be lit.

---

## Performing Related Adjustments and Verification Tests

In the following section, all assemblies that require adjustments and verification tests are listed. Each assembly is followed by a list of adjustments and verification tests that must be performed to ensure proper operation after an assembly has been repaired, replaced, or adjusted.

---

**Note** If an assembly listing says “All verification tests”, then perform all of the following verification tests for that assembly:

- Test 01. Switch Repeatability
  - Test 02. External Mixer Gain Calibration
  - Test 03. Gain and Flatness Calibration
  - Test 04. Flatness Below 50 MHz
  - Test 05. Microwave Gain and Noise Figure
  - Test 06. External Mixer Noise Figure
  - Test 07. Microwave TOI
  - Test 08. Diagnostics Check
  - Test 09. Front Panel LEDs Check
  - Test 10. 21.4 MHz IF Output Response
  - Test 11. IF Emissions and Harmonics
  - Test 12. EMIM LO Out Power and Harmonics
  - Test 13. 1st LO Out Power and Harmonics
  - Test 14. TUNE+SPAN+PRESEL PEAK Output
  - Test 15. LO Input Amplitude Range
  - Test 16. Microwave Image Rejection
  - Test 17. EMIM Image Rejection
  - Test 18. 2nd Converter Startup
  - Test 19. Microwave Residual Responses
  - Test 20. Microwave In-Range Multiples
  - Test 21. 321.4 MHz IF Output Bandwidth
- 

### A1 2.9 GHz low pass filter

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

### A2 RF first converter

Perform the following related adjustments:

Adjustment 02. 1st LO Power

Perform the following related verification tests:

All verification tests

### A3 4.4 GHz low pass filter

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

**Performing Related Adjustments and Verification Tests**

## A4 18 dB isolator

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

## A5, A7, A8, A9 second converter

Perform the following related adjustments:

2nd Converter Adjustments

Perform the following related verification tests:

All verification tests

## A6 programmable gain amplifier

Perform the following related adjustments:

Adjustment 02. 1st LO Power

2nd Converter Adjustments

Adjustment 04. Last Converter Alignment

Adjustment 05. PGA Calibration

Perform the following related verification tests:

All verification tests

## A10 last converter

Perform the following related adjustments:

Adjustment 04. Last Converter Alignment

Perform the following related verification tests:

All verification tests

## A11 5 dB step attenuator

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

## A16 preamp/mixer

Perform the following related adjustments:

Adjustment 02. 1st LO Power

Adjustment 05. PGA Calibration

Perform the following related verification tests:

All verification tests

## A17 6 dB isolator

Perform the following related adjustments:

Adjustment 02. 1st LO Power

Perform the following related verification tests:

All verification tests

## A18 LO leveling amplifier

Perform the following related adjustments:

Adjustment 02. 1st LO Power

Perform the following related verification tests:

All verification tests

**Performing Related Adjustments and Verification Tests**

## A19 power supply/YTF driver

Perform the following related adjustments:

All adjustments

Perform the following related verification tests:

All verification tests

## A20 controller

Perform the following utility prior to any adjustments or verification tests:

INITIALIZE ENTIRE FRONT END EEPROM

Select **Utilities**, then **WRITE DUT EEPROM**. From this menu you can access the **INITIALIZE ENTIRE FRONT END EEPROM** utility.

Perform the following related adjustments:

Adjustment 02. 1st LO Power

Adjustment 05. PGA Calibration

Adjustment 06. YTF Alignment

Perform the following related verification tests:

All verification tests

## A21 pin switch/diplexer

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

## A22 status

Perform the following related adjustments:

None

Perform the following related verification tests:

Test 09. Front Panel LEDs Check

## A23 limiter

Perform the following related adjustments:

None

Perform the following related verification tests:

All verification tests

## Troubleshooting Utilities Menu

This Troubleshooting Utilities menu is available through the Utilities menu, located at the bottom of the main module verification software test menu. Some parts of this menu are referred to during the troubleshooting procedures and are available here for reference.

```
-----  
Troubleshooting Utilities  
-----
```

```
EXIT Wbfe_util  
CHANGE ET SETTINGS  
CHANGE DUT SETTINGS  
CHANGE DUT RAM/DAC CONTENTS  
READ DUT ROM/EEPROM CONTENTS
```

```
-----  
Menu for: CHANGE ET SETTINGS  
-----
```

```
EXIT THIS MENU  
PRESET  
DVM TO TUNE SPAN INPUT  
DVM TO TUNE SPAN OUTPUT  
DVM TO GATE BIAS  
DVM TO 8340 1V/GHz OUTPUT  
DVM TO A19J8 +15V  
DVM TO A19J8 +5V  
DVM TO A19J8 +8V  
DVM TO A19J8 +7V  
DVM TO A19J8 -15V  
DVM TO A19J8 +39V  
DUT 300MHz FROM 70900  
DUT 300MHz FROM 8566  
DUT 21.4MHz OUT TO IF  
DUT 21.4MHz OUT TO SA  
DUT 321.4MHz OUT TO SA  
DUT LO FROM 70900  
DUT LO FROM 8340  
DUT TUNE + SPAN FROM 70900  
DUT TUNE + SPAN OPEN  
DUT TUNE + SPAN FROM 8340 1V/GHz
```

```
-----  
Menu for: CHANGE DUT SETTINGS  
-----
```

```
EXIT THIS MENU  
PRESET FRONT END  
PERFORM SELF TEST ON FRONT END  
SELECT BYPASS PATH  
SELECT PRESELECTOR PATH  
SELECT 1H- BAND  
SELECT 1L- BAND  
SELECT 2L- BAND  
SELECT 4L+ BAND  
SELECT mm BAND  
SET YTF DRIVE FILTER ON  
SET YTF DRIVE FILTER OFF  
SEND HYSTERESIS PULSE  
SEND PREPARE TO SWEEP
```

-----  
Menu for: CHANGE DUT RAM/DAC CONTENTS  
-----

EXIT THIS MENU  
CHANGE OFFSET DAC VALUE  
CHANGE GAIN DAC VALUE  
CHANGE DELAY DAC VALUE  
CHANGE PEAK DAC VALUE  
CHANGE BREAK POINT DAC VALUE  
CHANGE PGA DAC VALUE  
CHANGE PGA GAIN

-----  
Menu for: READ DUT ROM/EEPROM CONTENTS  
-----

EXIT THIS MENU  
DISPLAY EEPROM YTF DELAY DAC VALUES  
DISPLAY EEPROM YTF GAIN DAC VALUES  
DISPLAY EEPROM YTF OFFSET DAC VALUES  
DISPLAY EEPROM YTF BREAK POINT DAC VALUES  
DISPLAY EEPROM PGA OFFSET VALUES  
DISPLAY EEPROM PGA DAC TABLE  
DISPLAY EEPROM LO POWER DAC VALUES  
DISPLAY EEPROM EMEM GAIN DAC VALUES  
DISPLAY EEPROM EMIM GAIN DAC VALUES  
DISPLAY ROM FIRMWARE DATE  
DISPLAY EEPROM CALIBRATION DATA DATE  
DISPLAY ENTIRE FRONT END CAPABILITY STRING  
DISPLAY CURRENT CONFIGURATION  
DISPLAY MSIB STATUS BYTE  
DISPLAY EEPROM CONTENTS AT SPECIFIED ADDRESS  
DISPLAY EEPROM CONTENTS FOR SPECIFIED ADDRESS RANGE  
DISPLAY EEPROM CHECKSUM VALUE

-----  
Menu for: WRITE DUT EEPROM  
-----

EXIT THIS MENU  
INITIALIZE ENTIRE FRONT END EEPROM  
INITIALIZE ENTIRE FRONT END CAPABILITY STRING

**Troubleshooting Utilities Menu**

**Overall Block Diagram of HP 70909A or HP 70910A RF section**

Front page for Foldout Goes Here (This is just a place holder.)

**Figure 7-6. Overall Block Diagram of HP 70909A or HP 70910A RF section**

**Overall Block Diagram of HP 70909A or HP 70910A RF section**

Back page for Foldout Goes Here (This is just a place holder.)

## Replacing Major Assemblies

---

### Overview In this chapter you will learn about:

- Each of the equipment setups used during module verification tests

---

This chapter contains procedures for removal and replacement of major assemblies in your RF section.

**Note** Because this service guide is part of an Option OB3 package which consists of two manuals, refer to Manual 2 of this option set for information on part listings and schematics.

#### Manual 2

Manual 2 is a separate volume that contains packets of component-level repair information for each RF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. This manual also contains a table that can be used to cross reference different board assemblies that have different serial prefix breaks.

---

In this chapter, removal and replacement procedures are given for the following assemblies:

Module Cover .....	8-2
Front Panel .....	8-4
Rear Panel .....	8-6
A2 RF First Converter .....	8-8
A5, A7, A8, A9 Second Converter .....	8-10
A6 Programmable Gain Amplifier .....	8-12
A10 Last Converter .....	8-14
A11 5 dB Step Attenuator .....	8-16
A12 RF Switch/A15 RF Switch (HP 70910A RF Section Only) .....	8-18
A14 YTF .....	8-20
A16 Preamp/Mixer .....	8-22
A18 LO Leveling Amplifier .....	8-24
A19 Power Supply/YTF Driver Service Position .....	8-26
A19 Power Supply/YTF Driver .....	8-28
A20 Controller .....	8-30
A22 Status .....	8-32

---

## Module Cover

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

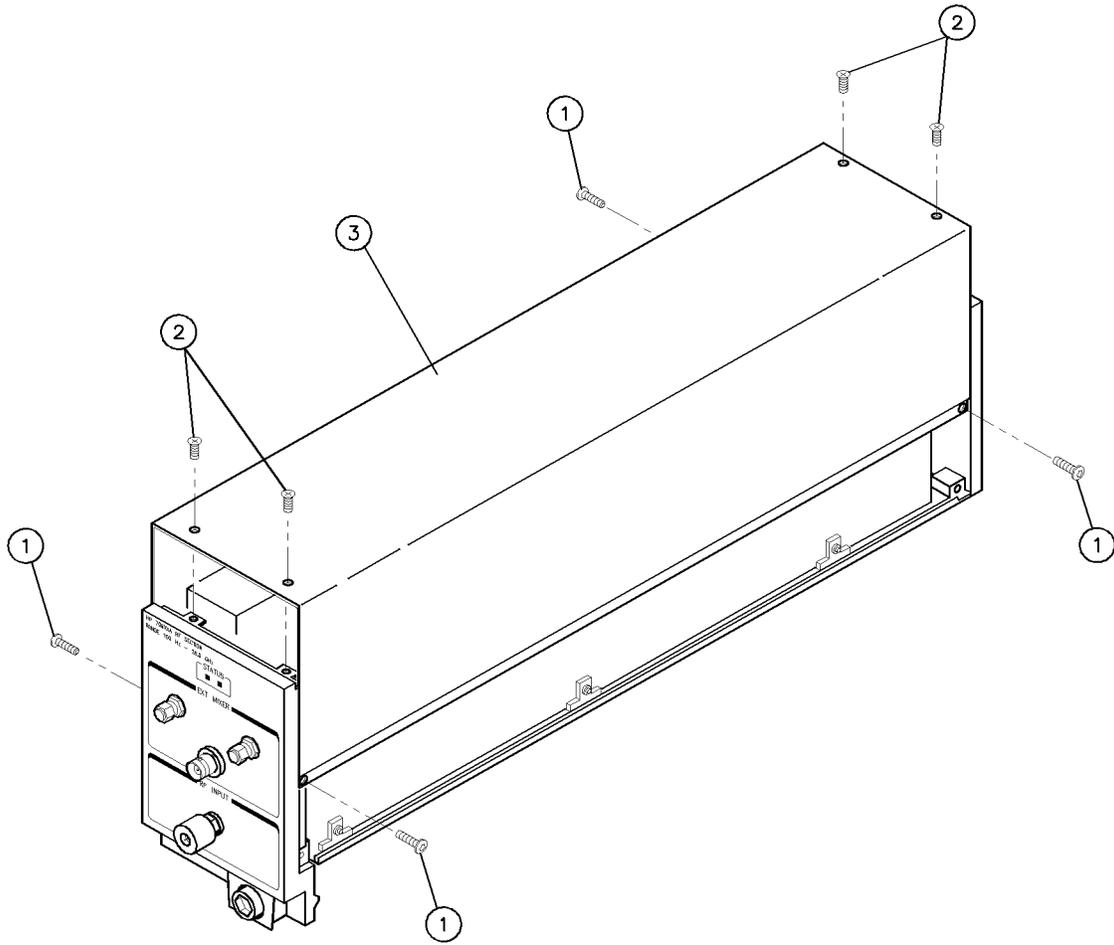
---

### To Remove the Module Cover

1. Remove the four side screws (1).
2. Remove the four top screws (2).
3. Remove the module cover (3).

### To Replace the Module Cover

1. Replace the module cover (3).
2. Replace the four top screws (2)
3. Replace the four side screws (1).



modvr.

Figure 8-1. Module Cover Removal/Replacement

---

## Front Panel

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

---

**Note** Be careful not to bend the rigid coaxial cables or damage any center connector.

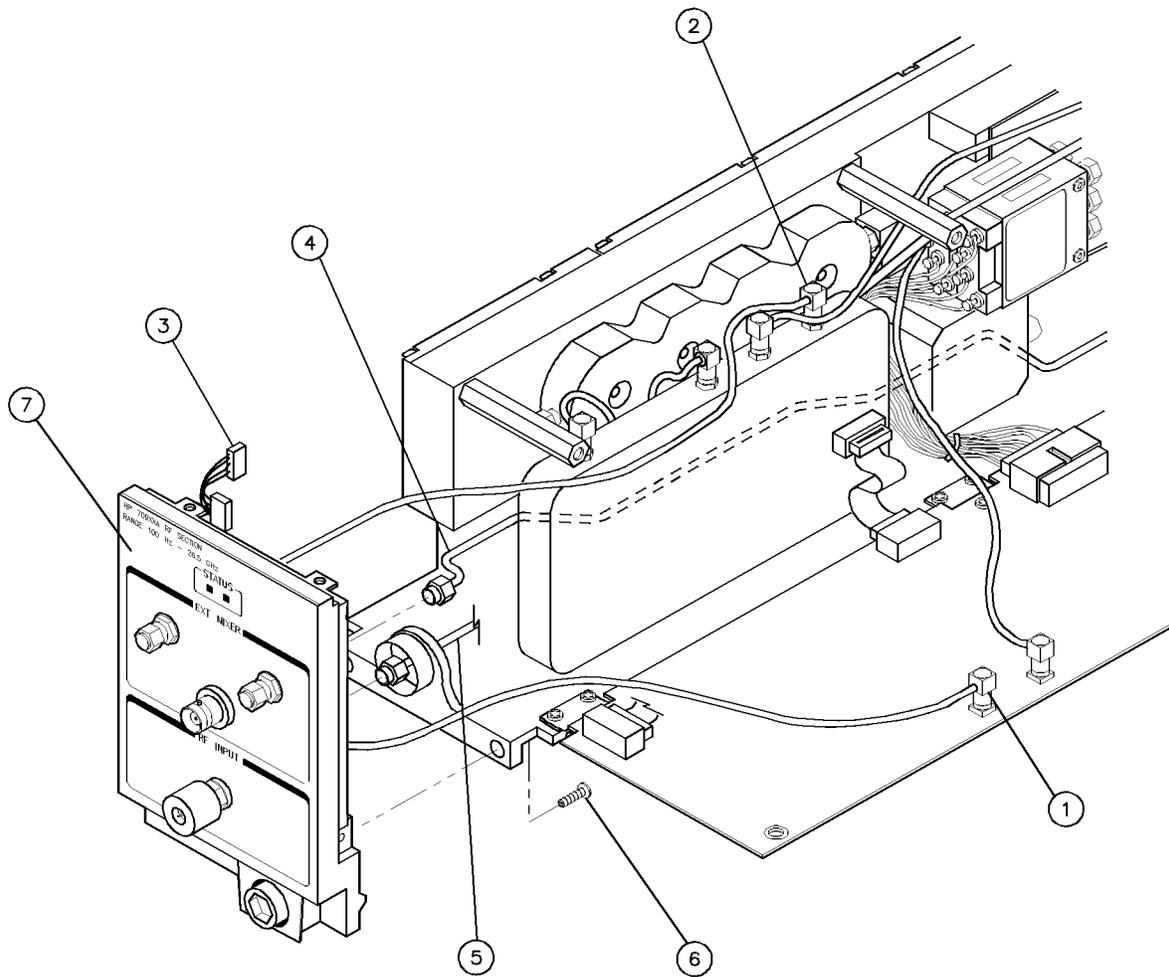
---

### To Remove the Front Panel

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Disconnect the SMB cable W3 (1) from A19 power supply/YTF driver J7.
4. Disconnect the SMB cable W1 (2) from A6 programmable gain amplifier J2.
5. Disconnect ribbon cable W4 (3) from the A20 controller J5.
6. Disconnect rigid coax cable W2 (4) from the HP 70909A or HP 70910A RF section’s front panel EXT MIXER LO output.
7. Disconnect rigid coax cable W5 (5) from the HP 70909A or HP 70910A RF section’s front panel RF INPUT.
8. Remove the two bottom screws (6) using a 3mm ball hex bit.
9. Carefully pull the front panel (7) forward.

### To Replace the Front Panel

1. Position the front panel against the module base. Carefully line up the front-panel HP 70909A or HP 70910A RF section’s front panel RF INPUT and rigid coax cable W5 (5), and loosely reconnect them. Be careful not to bend the cable when moving the module.
2. Replace the two screws (6) that hold the front panel to the base of the module. Torque the screws to 10 inch-pounds.
3. Reconnect the SMB cable W3 (1) to the A19 power supply/YTF driver J7.
4. Reconnect the SMB cable W1 (2) to the A6 programmable gain amplifier J2.
5. Reconnect ribbon cable W4 (3) to the A20 controller J5.
6. Reconnect rigid coax cable W2 (4) to the HP 70909A or HP 70910A RF section’s front panel EXT MIXER LO output.
7. Torque W2 (4) and W5 (5) to 10 inch-pounds using a 5/16 inch torque wrench.
8. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
9. Replace the module cover. (Refer to Figure 8-1.)



frntpnl

Figure 8-2. Front Panel Removal/Replacement

---

## Rear Panel

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

---

### To Remove the Rear Panel

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Disconnect ribbon cable W29 (HP 70909A RF section) or W30 (HP 70910A RF section) from the A19 power supply/YTF driver J1 (1) and A20 controller J1 (2).
4. Remove the 50 ohm load (5) from HP 70909A or HP 70910A RF section’s rear panel 1ST LO OUT.
5. Remove the hex-nut (4) and washer (3) from 1st LO IN and 1st LO OUT.
6. Remove the four nuts (6) and washers (7) from HP 70909A RF section rear panel connectors. TUNE/SPAN IN has washers (8) on inside and outside of rear panel.
7. Remove the three screws (9) that hold the rear-panel to the module base.
8. Remove the screw (10) that holds the rear-panel to the A10 last converter.
9. Remove the rear panel (11).

### To Replace the Rear Panel

1. Position the rear panel against the module, being careful not to damage the rear panel ground spring, and reinsert the rear panel 1st LO IN connector, the 1st LO OUT connector, the 321.4 MHz OUT connector, and the TUNE/SPAN input connector.
2. Replace the three screws (9) that hold the rear-panel to the module base. Torque the screws to 20 inch-pounds.
3. Replace the screw (10) that holds the rear-panel to the A10 last converter. Torque the screw to 9 inch-pounds.
4. Replace the rear panel connector hex-nuts and washers. Torque to 6 inch-pounds.
5. Replace the 50 ohm load (5) on HP 70909A or HP 70910A RF section’s rear panel 1ST LO OUT.
6. Reconnect ribbon cable W29 (HP 70909A RF section) or W30 (HP 70910A RF section) to A19 power supply/YTF driver J1 (1) and A20 controller J1 (2).
7. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
8. Replace the module cover. (Refer to Figure 8-1.)

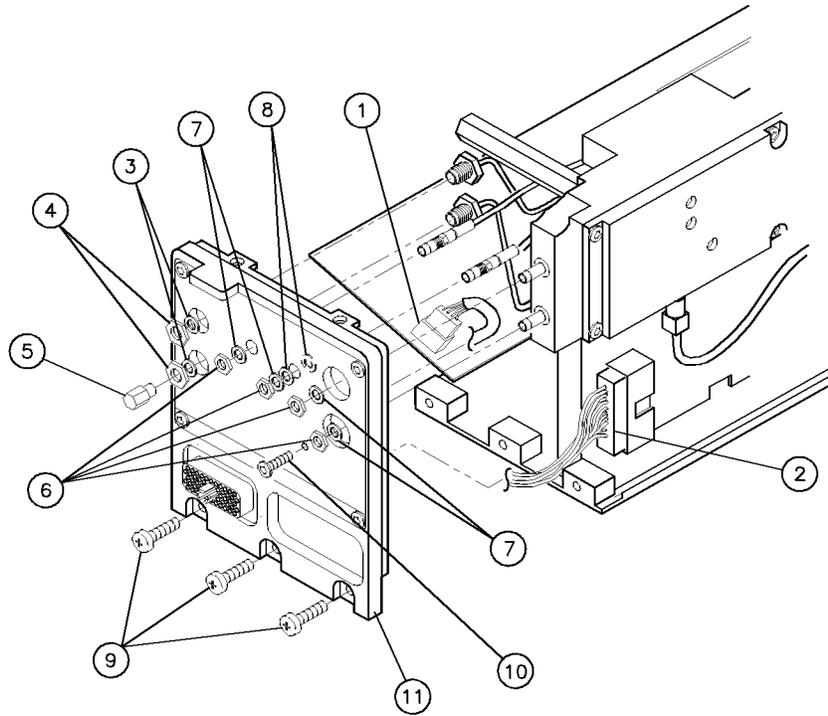


Figure 8-3. Rear Panel Removal/Replacement

rp.

---

## A2 RF First Converter

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

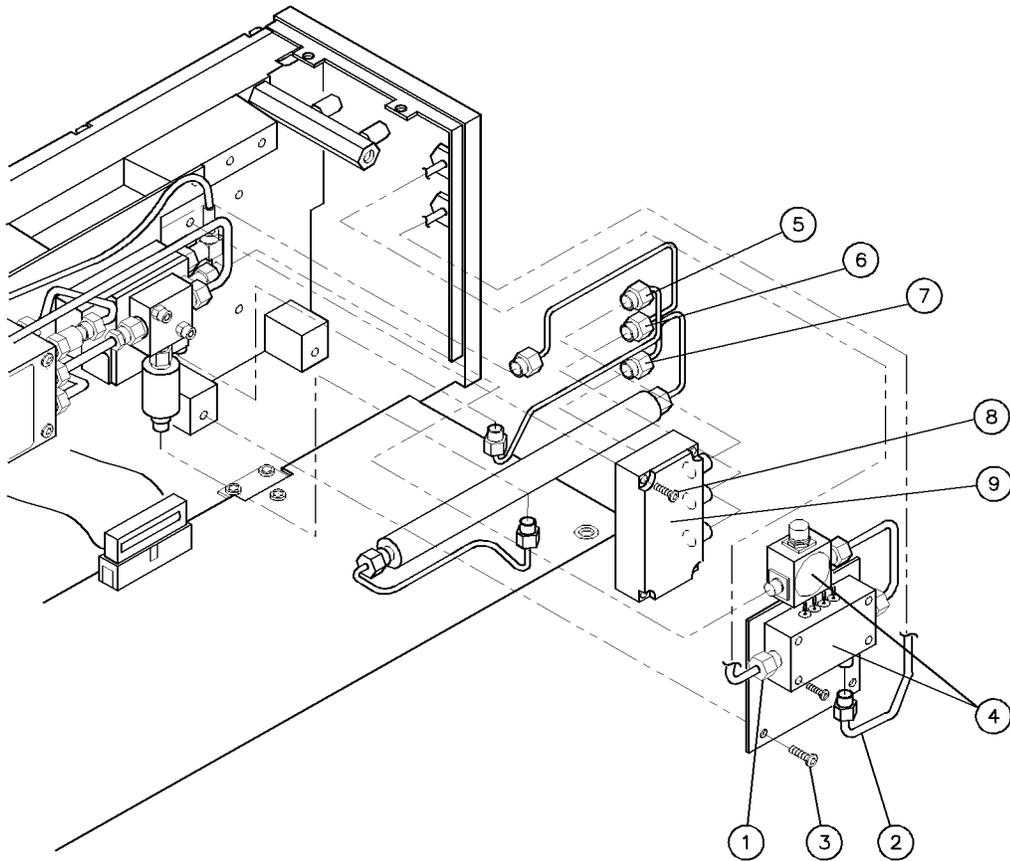
---

### To Remove the A2 RF First Converter

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Remove the A19 power supply/YTF driver. (Refer to Figure 8-14.)
4. Disconnect rigid coax cable W32 (1) from A18 LO leveling amplifier 1st LO IN.
5. Disconnect rigid coax cable W33 (2) from A18 LO leveling amplifier 1st LO OUT.
6. Remove two screws (3).
7. Remove the A19 power supply/YTF driver. (Refer to Figure 8-14.)
8. Carefully pull the A17 6 dB isolator/A18 LO leveling amplifier combination (4) from the module being careful not to damage any rigid coax cables.
9. Disconnect rigid coax cable W26 (5) from A2 RF first converter LO port.
10. Disconnect rigid coax cable W23 (6) from A2 RF first converter IF port.
11. Disconnect rigid coax cable W24 (7) from A2 RF first converter RF port.
12. Remove four screws (8).
13. Carefully pull A2 RF first converter (9) from the module, being careful not to damage any rigid coax cables.

### To Replace the A2 RF First Converter

1. Replace the A2 RF first converter (9) into the module, being careful not to damage any rigid coax cables.
2. Replace four screws (8). Torque to 6 inch-pounds.
3. Reconnect rigid coax cable W26 (5) to A2 RF first converter LO port.
4. Reconnect rigid coax cable W23 (6) to A2 RF first converter IF port.
5. Reconnect rigid coax cable W24 (7) to A2 RF first converter RF port. Torque all cables to 10 inch-pounds.
6. Carefully reposition the A17 6 dB isolator/A18 LO leveling amplifier combination (4) into the module.
7. Replace two screws (3).
8. Reconnect rigid coax cable W32 (1) to A18 LO leveling amplifier 1st LO IN.
9. Reconnect rigid coax cable W33 (2) to A18 LO leveling amplifier 1st LO OUT. Torque all cables to 10 inch-pounds.
10. Replace the A19 power supply/YTF driver and place in normal position.
11. Replace the module cover. (Refer to Figure 8-1.)



a2rem

Figure 8-4. A2 RF First Converter Removal/Replacement

---

## A5, A7, A8, A9 Second Converter

---

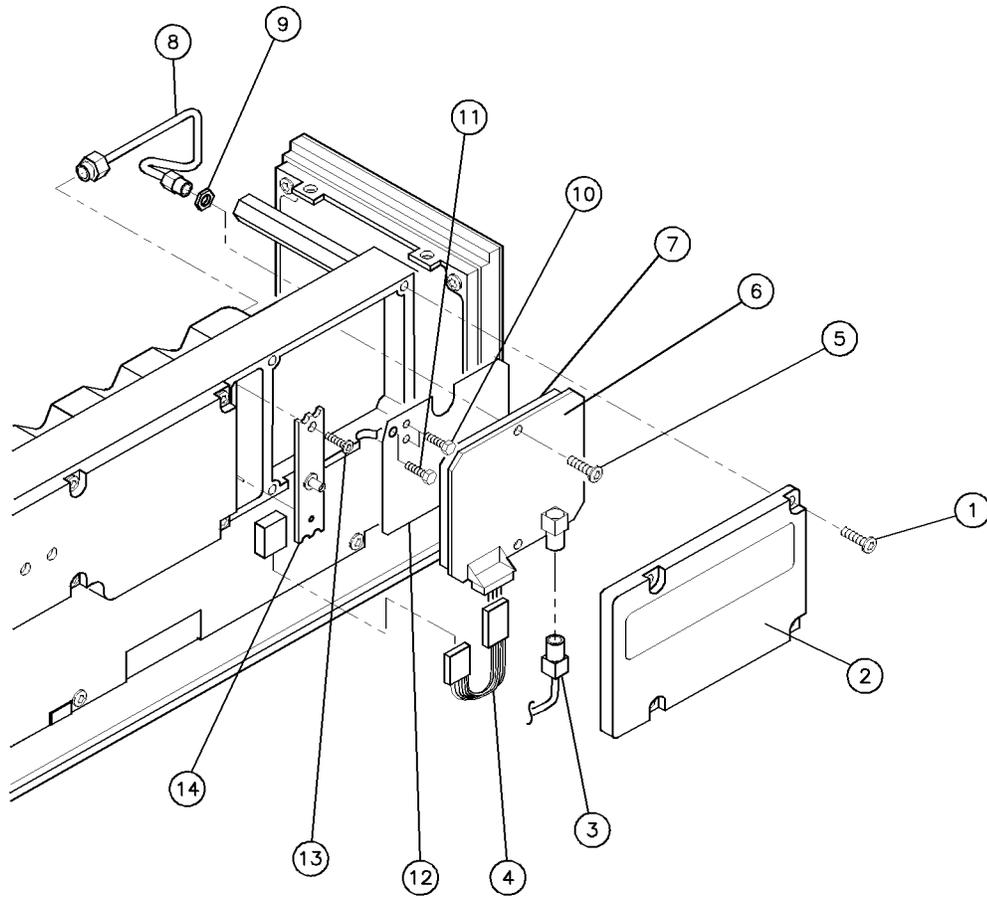
- CAUTION**
- This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.
  - These assemblies contain connector pins that can be easily damaged if proper alignment is not maintained when replacing the circuit cards.
- 

### To Remove the A5, A7, A8, A9 Second Converter

1. Remove the module cover. (Refer to Figure 8-1.)
2. Remove four screws (1) and the cover (2).
3. Disconnect the SMB cable W14 from A10 last converter J4. (Refer to Figure 8-7.)
4. Disconnect the SMB cable W14 (3) from A9 2nd LO PLL assembly J1.
5. Disconnect ribbon cable W37 (4) from the A9 2nd LO PLL assembly J2.
6. Remove the two screws (5).
7. Remove A9 2nd LO PLL assembly (6) and cast cover (7) from the module.
8. Separate the A9 2nd LO PLL assembly (6) from the cast cover (7) by pulling six connector pins apart.
9. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
10. Remove the A6 programmable gain amplifier. (Refer to Figure 8-6.)
11. Remove rigid coax cable W6 (8).
12. Remove one nut (9).
13. Remove two screws (10) and the gold screw (11).
14. Remove A5 VCO/sampler (12) from the module.
15. Remove one screw (13).
16. Pull A8 321.4 MHz matching assembly (14) from the module until clear of the connector pin and remove.

### To Replace the A5, A7, A8, A9 Second Converter

1. Position A8 321.4 MHz matching assembly (14) in the module with the connector pin in the socket and press into the housing.
2. Replace one screw (13).
3. Replace A5 VCO/sampler (12) in the module housing.
4. Replace the gold screw (11) and the two screws (10). Torque screw to 3 inch-pounds.
5. Replace one nut (9).
6. Replace rigid coax cable W6 (8). Torque cable to 10 inch-pounds.
7. Return A19 power supply/YTF driver to normal position. (Refer to Figure 8-13.)
8. Combine the A9 2nd LO PLL assembly (6) and the cast cover (7) by aligning the six connector pins and pressing together.
9. Replace A9 2nd LO PLL assembly (6) and cast cover (7) into the module.
10. Replace the two screws (5).
11. Reconnect the SMB cable W14 (3) to A9 2nd LO PLL assembly J1.
12. Reconnect ribbon cable W4 (4) to the A9 2nd LO PLL assembly J2.
13. Replace the cover (2) and four screws (1).
14. Replace the A6 programmable gain amplifier.
15. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
16. Replace the module cover. (Refer to Figure 8-1.)



o589rem

**Figure 8-5. A5, A7, A8, A9 Second Converter Removal/Replacement**

---

## A6 Programmable Gain Amplifier

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

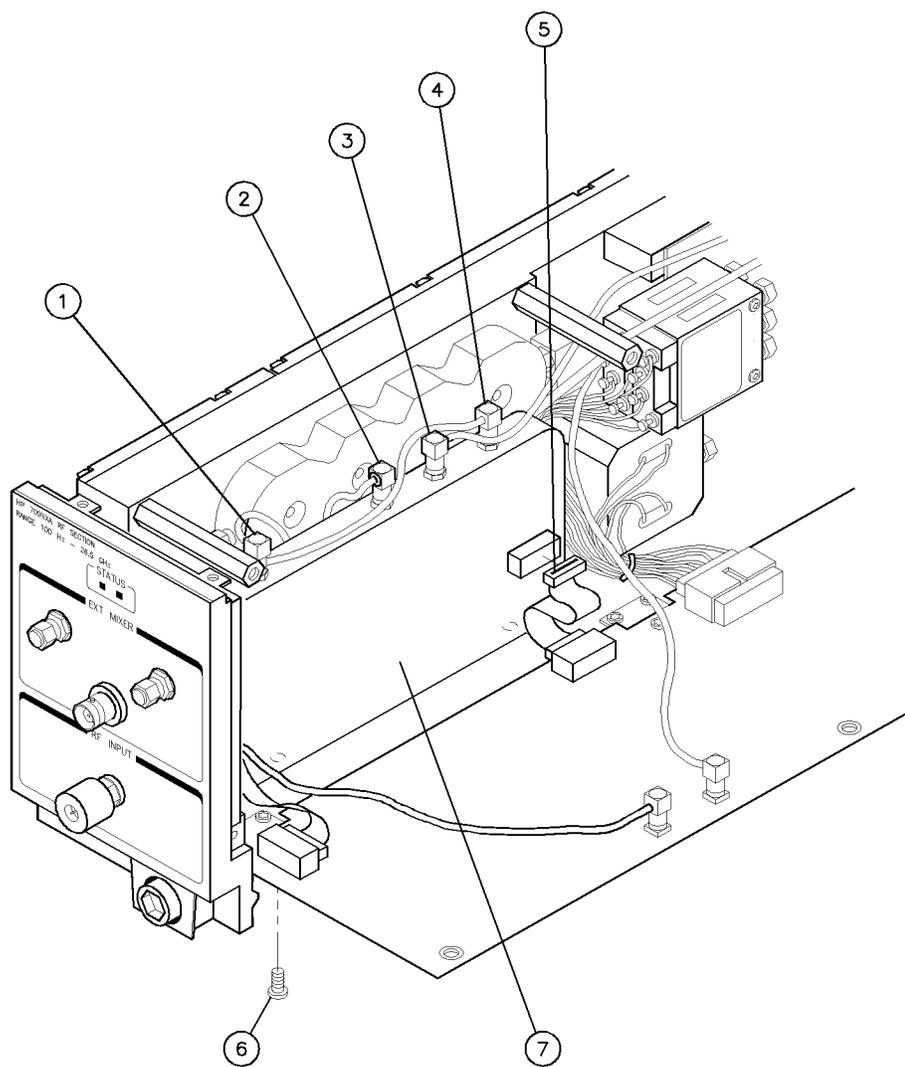
---

### To Remove the A6 Programmable Gain Amplifier

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Disconnect the SMB cable W7 (1) from A6 programmable gain amplifier J5.
4. Disconnect the SMB cable W8 (2) from A6 programmable gain amplifier J4.
5. Disconnect the SMB cable W9 (3) from A6 programmable gain amplifier J3.
6. Disconnect the SMB cable W1 (4) from A6 programmable gain amplifier J2.
7. Disconnect the ribbon cable W13 (5) from A6 programmable gain amplifier J1.
8. Remove two screws (6).
9. Remove A6 programmable gain amplifier (7) from the module.

### To Replace the A6 Programmable Gain Amplifier

1. Position A6 programmable gain amplifier (7) in the module and replace two screws (6).
2. Reconnect the SMB cable W7 (1) to A6 programmable gain amplifier J5.
3. Reconnect the SMB cable W8 (2) to A6 programmable gain amplifier J4.
4. Reconnect the SMB cable W9 (3) to A6 programmable gain amplifier J3.
5. Reconnect the SMB cable W1 (4) to A6 programmable gain amplifier J2.
6. Reconnect the ribbon cable W13 (5) to A6 programmable gain amplifier J1.
7. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
8. Replace the module cover. (Refer to Figure 8-1.)



j2345

Figure 8-6. A6 Programmable Gain Amplifier Removal/Replacement

---

## A10 Last Converter

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

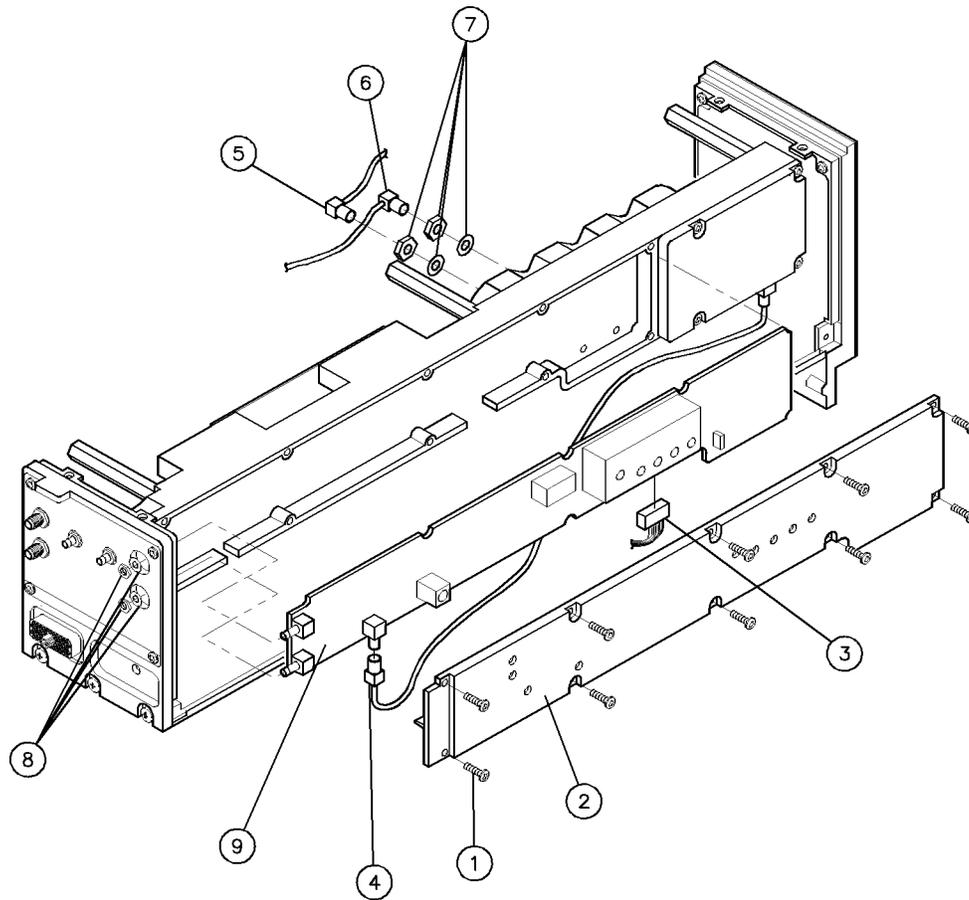
---

### To Remove the A10 Last Converter

1. Remove the module cover. (Refer to Figure 8-1.)
2. Remove ten screws (1) and the cover (2).
3. Remove the A6 programmable gain amplifier. (Refer to Figure 8-6.)
4. Disconnect the ribbon cable W12 (3) from A10 last converter J4.
5. Disconnect the SMB cable W14 (4) from A10 last converter J5.
6. Disconnect the SMB cable W7 (5) from A10 last converter J1.
7. Disconnect the SMB cable W10 (6) from A10 last converter J2.
8. Remove two nuts and washers (7).
9. Remove two nuts and washers (8).
10. Remove A10 last converter (9).

### To Replace the A10 Last Converter

1. Replace A10 last converter (9) in the module.
2. Replace two nuts and washers (8).
3. Replace two nuts and washers (7).
4. Reconnect the SMB cable W14 (4) to A10 last converter J5.
5. Reconnect the SMB cable W7 (5) to A10 last converter J1.
6. Reconnect the SMB cable W10 (6) to A10 last converter J2.
7. Replace the A6 programmable gain amplifier. (Refer to Figure 8-7.)
8. Reconnect the ribbon cable W12 (3) to A10 last converter J4.
9. Replace the cover (2) and ten screws (1).
10. Replace the module cover. (Refer to Figure 8-1.)



a10bdrem

Figure 8-7. A10 Last Converter Removal/Replacement

---

## A11 5 dB Step Attenuator

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

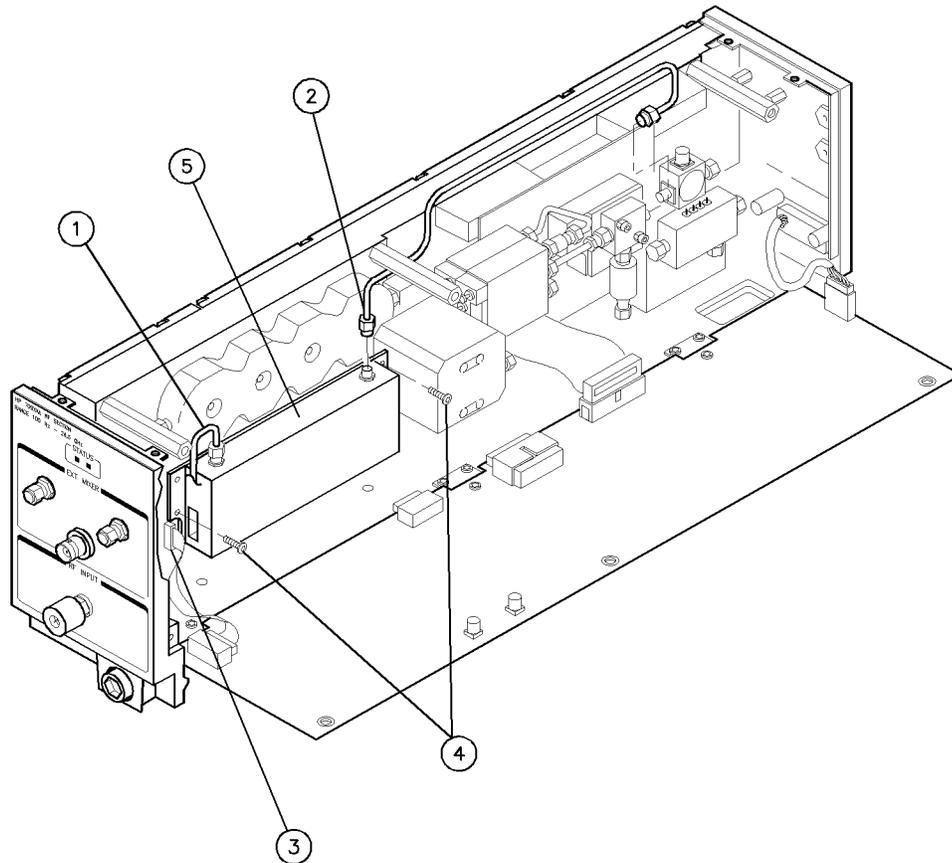
---

### To Remove the A11 5 dB Step Attenuator

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Remove the A6 programmable gain amplifier. (Refer to Figure 8-7.)
4. Disconnect the rigid coax cable W5 (1) from A11 5 dB step attenuator INPUT.
5. Disconnect the rigid coax cable W18 (2) from A11 5 dB step attenuator OUTPUT.
6. Disconnect the ribbon cable A11W1 (3) from A19 power supply/YTF driver J10.
7. Remove two screws (4).
8. Remove A11 5 dB step attenuator (5).

### To Replace the A11 5 dB Step Attenuator

1. Replace A11 5 dB step attenuator (5) in the module.
2. Replace two screws (4).
3. Reconnect the rigid coax cable W5 (1) to A11 5 dB step attenuator INPUT.
4. Reconnect the rigid coax cable W18 (2) to A11 5 dB step attenuator OUTPUT.
5. Torque all cables to 10 inch-pounds.
6. Reconnect the ribbon cable A11W1 (3) to A19 power supply/YTF driver J10.
7. Replace the A6 programmable gain amplifier. (Refer to Figure 8-7.)
8. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
9. Replace the module cover. (Refer to Figure 8-1.)



a11rem

**Figure 8-8. A11 5 dB Step Attenuator Removal/Replacement**

---

## A12 RF Switch/A15 RF Switch (HP 70910A RF Section Only)

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

---

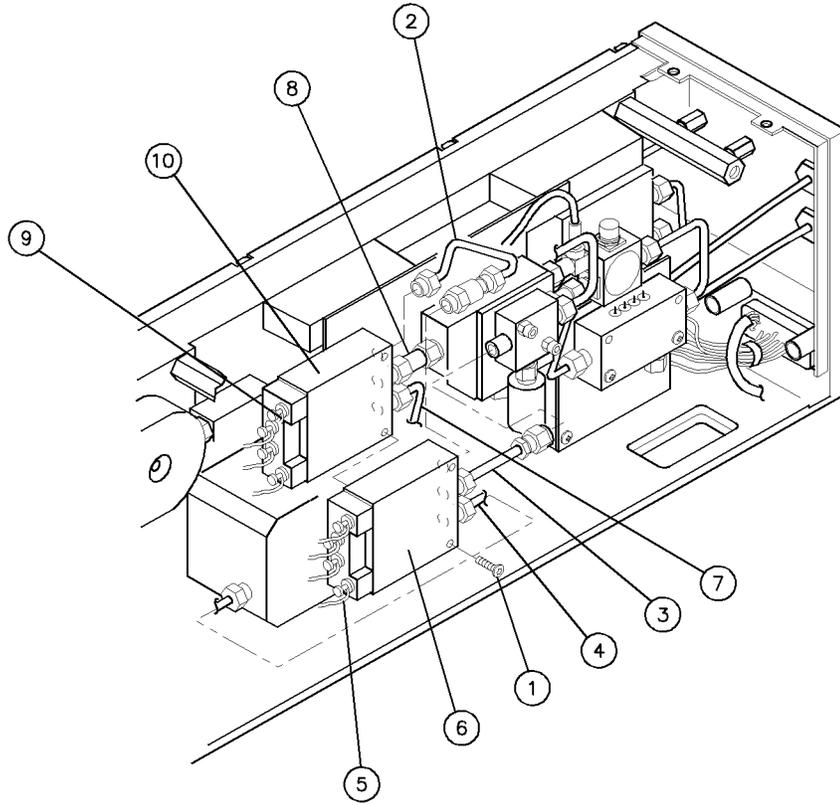
### To Remove the A12 RF Switch/A15 RF Switch

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Remove two screws (1).
4. Remove the rigid coax cable W18 (2) from A12 RF switch port 2 and A15 RF switch port 2.
5. Remove the rigid coax cable W17 (3) from A12 RF switch port C and A21 pin switch/diplexer.
6. Disconnect the rigid coax cable W15 (4) from A12 RF switch port 1.
7. Tag and unsolder four wires (5) from A12 RF switch.
8. Remove A12 RF switch (6).
9. Disconnect the rigid coax cable W16 (7) from A15 RF switch port 1.
10. Disconnect the SMA adapter W21 (8) from A15 RF switch port C.
11. Tag and unsolder four wires (9) from A15 RF switch.
12. Remove A15 RF switch (10).

### To Replace the A12 RF Switch/A15 RF Switch

1. Replace A15 RF switch (10) in the module.
2. Resolder four wires (9) to A15 RF switch.
3. Reconnect the SMA adapter W21 (8) to A15 RF switch port C.
4. Reconnect the rigid coax cable W16 (7) to A15 RF switch port 1.
5. Replace A12 RF switch (6) in the module.
6. Resolder four wires (5) to A12 RF switch.
7. Reconnect the rigid coax cable W15 (4) to A12 RF switch port 1.
8. Replace the rigid coax cable W17 (3) to A12 RF switch port C and A21 pin switch/diplexer.
9. Replace the rigid coax cable W18 (2) to A12 RF switch port 2 and A15 RF switch port 2.
10. Replace two screws (1).
11. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
12. Replace the module cover. (Refer to Figure 8-1.)

A12 RF Switch/A15 RF Switch (HP 70910A RF Section Only)



012015

Figure 8-9. A12 RF Switch/A15 RF Switch Removal/Replacement

---

## A14 YTF

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

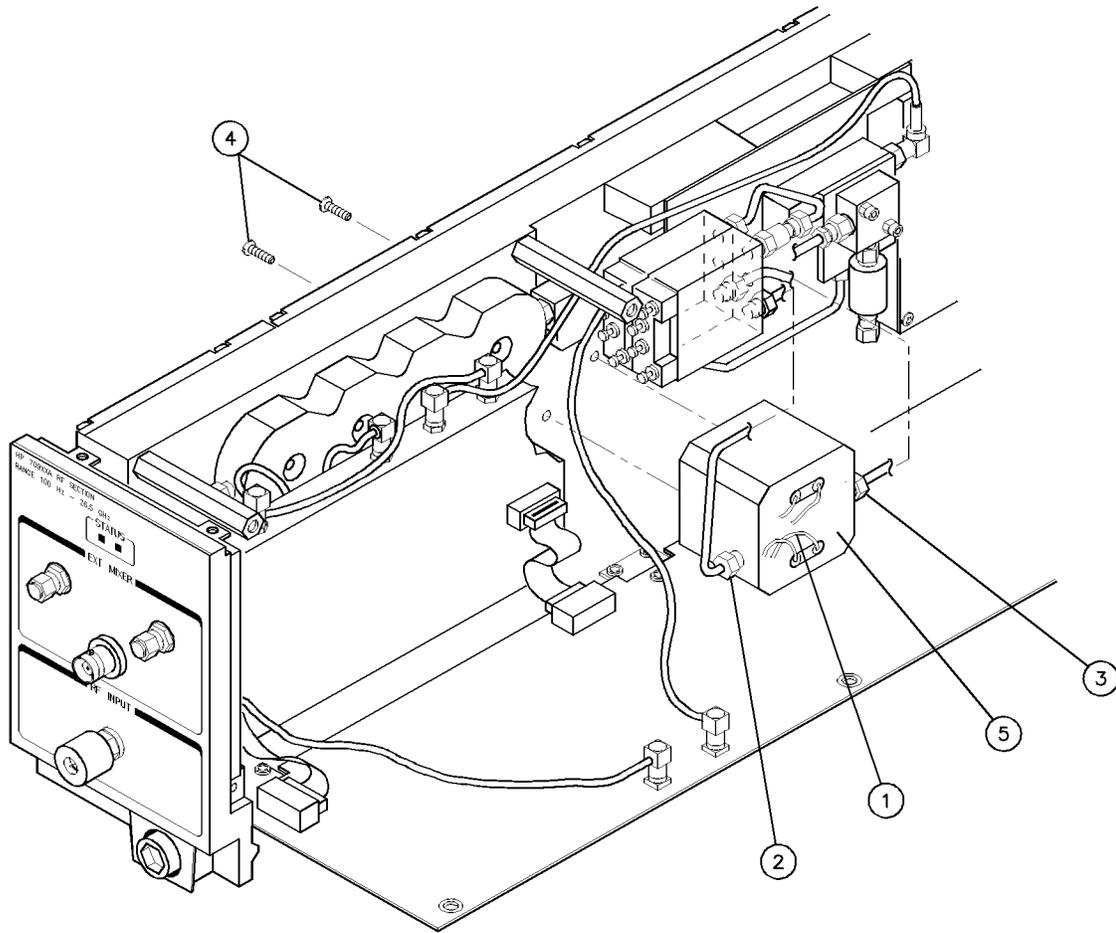
---

### To Remove the A14 YTF

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Remove the A20 controller. (Refer to Figure 8-15.)
4. Tag and unsolder four wires (1) from A14 YTF HEATERS/TUNING.
5. Disconnect the rigid coax cable W15 (HP 70909A RF section) or W19 (HP 70910A RF section) (2) from A14 YTF J1.
6. Disconnect the rigid coax cable W16 (HP 70909A RF section) or W20 (HP 70910A RF section) (3) from A14 YTF J2.
7. Remove two screws (4).
8. Remove A14 YTF (5).

### To Replace the A14 YTF

1. Replace A14 YTF (5) in the module.
2. Replace two screws (4).
3. Reconnect the rigid coax cable W15 (2) to A14 YTF J1.
4. Reconnect the rigid coax cable W16 (3) to A14 YTF J2.
5. Torque all cables to 10 inch-pounds.
6. Resolder four wires (1) to A14 YTF HEATERS/TUNING.
7. Replace the A20 controller. (Refer to Figure 8-15.)
8. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
9. Replace the module cover. (Refer to Figure 8-1.)



a14rem.

**Figure 8-10. A14 YTF Removal/Replacement**

---

## A16 Preamp/Mixer

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

---

### To Remove the A16 Preamp/Mixer

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Disconnect the rigid coax cable W36 (1) from A23 limiter.
4. Disconnect the rigid coax cable W18 (2) from A21 pin switch/diplexer.
5. Remove one screw (3).
6. Remove two screws (4).
7. Disconnect the rigid coax cable W17 (5) from A12 RF switch port C.
8. Carefully pull the A21 pin switch/diplexer/A23 limiter combination (6) from the module and reposition to access A16 preamp/mixer, being careful not to damage any rigid coax cables.
9. Tag and unsolder four wires (7) from A16 preamp/mixer.
10. Disconnect the rigid coax cable W26 (8) from A16 preamp/mixer.
11. Disconnect the rigid coax cable W2 (9) from A16 preamp/mixer.
12. Disconnect the SMA adapter W21 (10) from A16 preamp/mixer.
13. Disconnect the SMA adapter W28 (11) from A16 preamp/mixer.
14. Disconnect the SMA cable W9 (12) from A16 preamp/mixer.
15. Remove A16 preamp/mixer (13).

### To Replace the A16 Preamp/Mixer

1. Replace A16 preamp/mixer (13) in the module.
2. Reconnect the SMA adapter W21 (10) to A16 preamp/mixer.
3. Reconnect the SMA adapter W28 (11) to A16 preamp/mixer.
4. Reconnect the SMA cable W9 (12) to A16 preamp/mixer.
5. Reconnect the rigid coax cable W26 (8) to A16 preamp/mixer.
6. Reconnect the rigid coax cable W2 (9) to A16 preamp/mixer.
7. Torque all cables to 10 inch-pounds.
8. Resolder four wires (7) to A16 preamp/mixer.
9. Reposition the A21 pin switch/diplexer/A23 limiter combination (6) on the A16 preamp/mixer, being careful not to damage any rigid coax cables. Reconnect the rigid coax cable W17 (5) to A12 RF switch port C.
10. Replace two screws (4).
11. Replace one screw (3).
12. Reconnect the rigid coax cable W36 (1) to A23 limiter.
13. Reconnect the rigid coax cable W18 (2) to A21 pin switch/diplexer.
14. Torque all cables to 10 inch-pounds.
15. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
16. Replace the module cover. (Refer to Figure 8-1.)

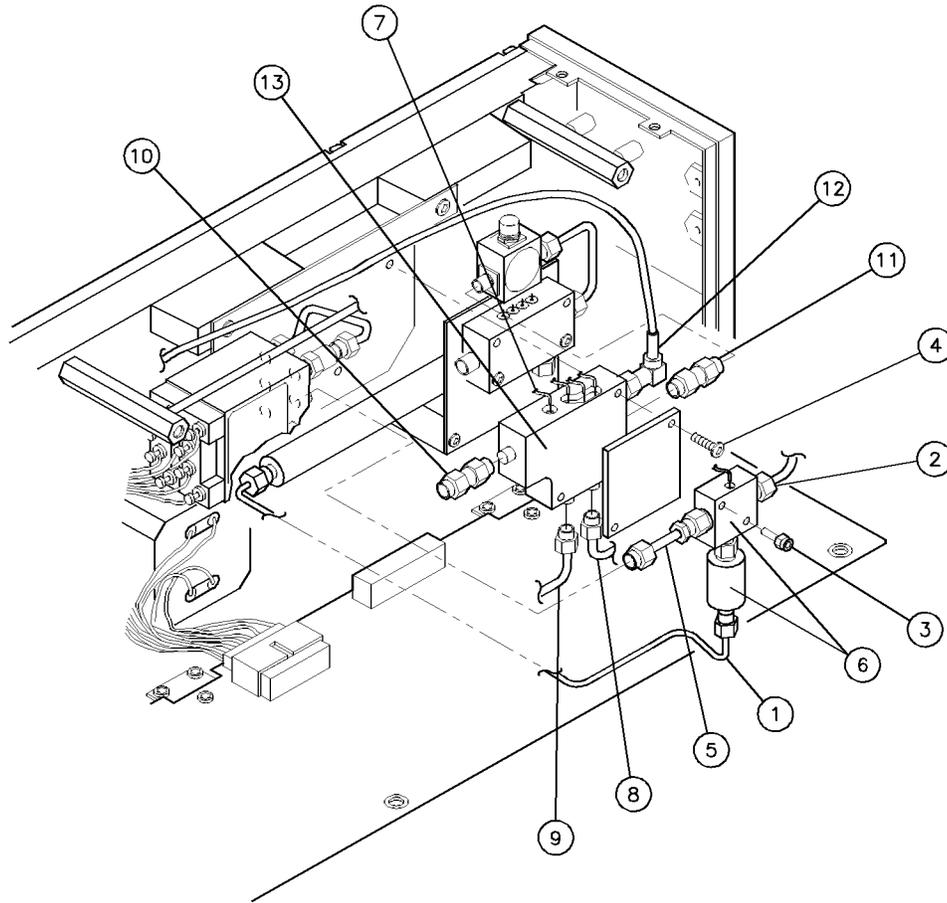


Figure 8-11. A16 Preamp/Mixer Removal/Replacement

a16rem.

---

## A18 LO Leveling Amplifier

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

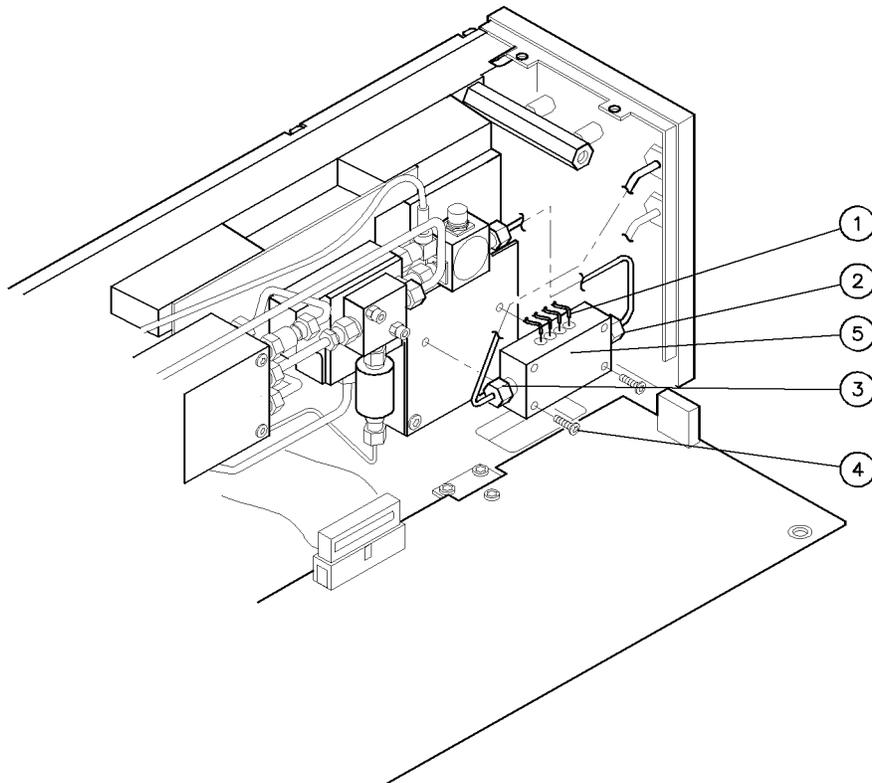
---

### To Remove the A18 LO Leveling Amplifier

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Tag and unsolder four wires (1) from A18 LO leveling amplifier.
4. Disconnect the rigid coax cable W27 (2) from A18 LO leveling amplifier LO OUT.
5. Disconnect the rigid coax cable W32 (3) from A18 LO leveling amplifier LO IN.
6. Remove two screws (4).
7. Remove A18 LO leveling amplifier (5).

### To Replace the A18 LO Leveling Amplifier

1. Replace A18 LO leveling amplifier (5) in the module.
2. Replace two screws (4).
3. Reconnect the rigid coax cable W27 (2) to A18 LO leveling amplifier LO OUT.
4. Reconnect the rigid coax cable W32 (3) to A18 LO leveling amplifier LO IN.
5. Torque all cables to 10 inch-pounds.
6. Resolder four wires (1) to A18 LO leveling amplifier.
7. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
8. Replace the module cover. (Refer to Figure 8-1.)



a18rem

**Figure 8-12. A18 LO Leveling Amplifier Removal/Replacement**

---

## A19 Power Supply/YTF Driver Service Position

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

---

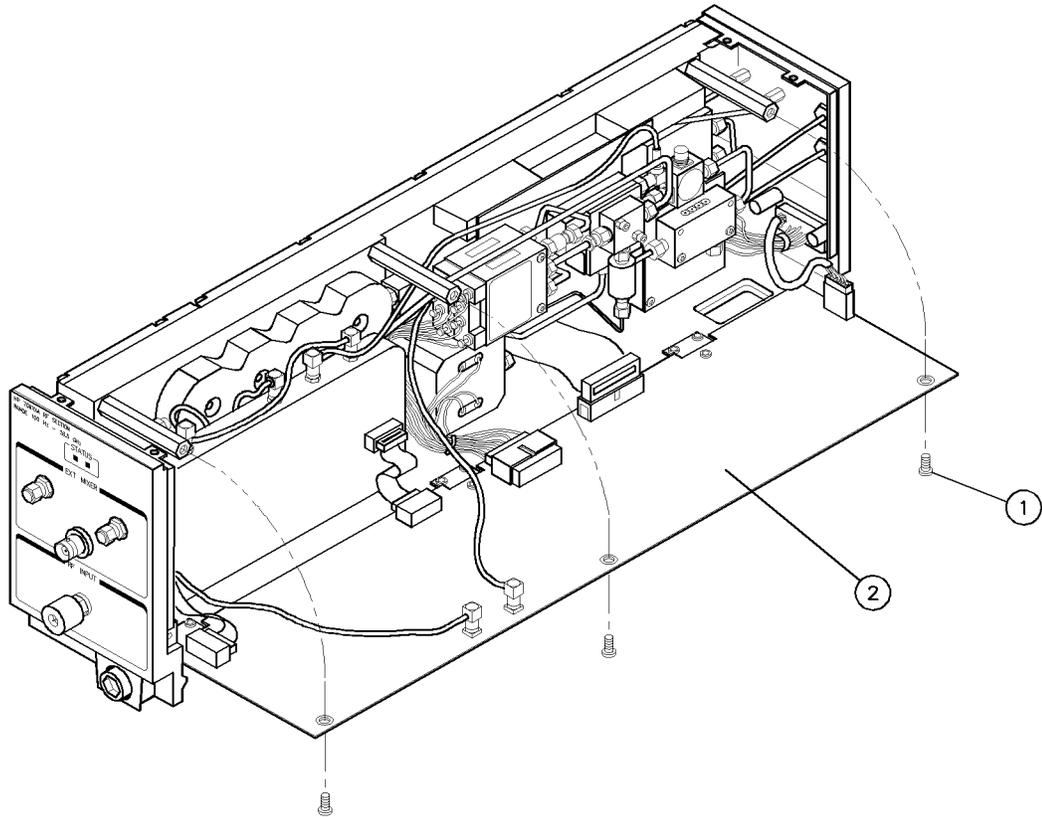
### To place the A19 Power Supply/YTF Driver in the Service Position

1. Remove the module cover. (Refer to Figure 8-1.)
2. Remove three screws (1).
3. Carefully fold A19 power supply/YTF driver (2) from the module as shown.

### To place the A19 Power Supply/YTF Driver in the Normal Position

1. Carefully fold A19 power supply/YTF driver (2) in the module being careful not to damage any cables.
2. Replace three screws (1).
3. Replace the module cover. (Refer to Figure 8-1.)

A19 Power Supply/YTF Driver Service Position



a19serv.

Figure 8-13. A19 Power Supply/YTF Driver Service Position

---

## A19 Power Supply/YTF Driver

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

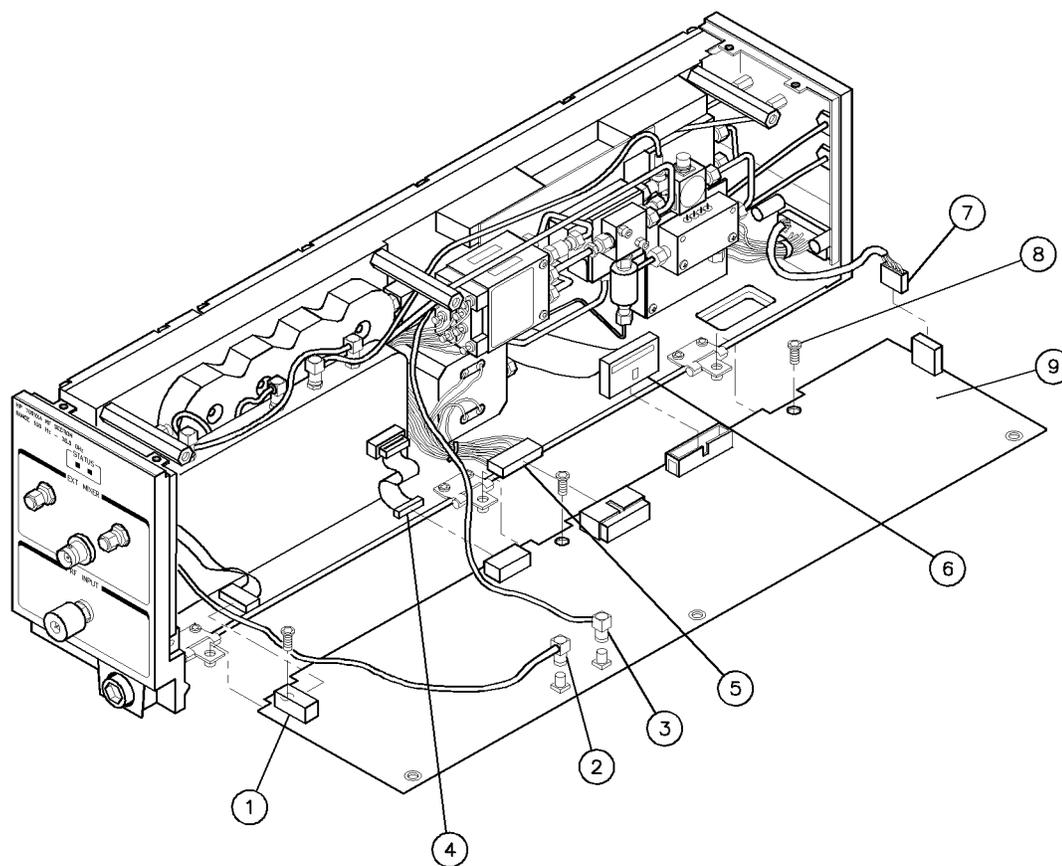
---

### To Remove the A19 Power Supply/YTF Driver

1. Remove the module cover. (Refer to Figure 8-1.)
2. Place A19 power supply/YTF driver in service position. (Refer to Figure 8-13.)
3. Disconnect the ribbon cable A11W1 (1) from A19 power supply/YTF driver J10.
4. Disconnect the SMB cable W3 (2) from A19 power supply/YTF driver J7.
5. Disconnect the SMB cable W34 (3) from A19 power supply/YTF driver J5.
6. Disconnect the ribbon cable W13 (4) from A19 power supply/YTF driver J4.
7. Disconnect the ribbon cable W35 (5) from A19 power supply/YTF driver J1.
8. Disconnect the ribbon cable W31 (6) from A19 power supply/YTF driver J2.
9. Disconnect the ribbon cable W29 (HP 70909A RF section) or W30 (HP 70910A RF section) (6) from A19 power supply/YTF driver J3.
10. Remove three screws (8).
11. Remove A19 power supply/YTF driver (9).

### To Replace the A19 Power Supply/YTF Driver

1. Replace A19 power supply/YTF driver (9) in the module.
2. Replace three screws (8).
3. Reconnect the ribbon cable A11W1 (1) to A19 power supply/YTF driver J10.
4. Reconnect the SMB cable W3 (2) to A19 power supply/YTF driver J7.
5. Reconnect the SMB cable W34 (3) to A19 power supply/YTF driver J5.
6. Reconnect the ribbon cable W13 (4) to A19 power supply/YTF driver J4.
7. Reconnect the ribbon cable W35 (5) to A19 power supply/YTF driver J1.
8. Reconnect the ribbon cable W31 (6) to A19 power supply/YTF driver J2.
9. Reconnect the ribbon cable W29 (HP 70909A RF section) or W30 (HP 70910A RF section) (6) to A19 power supply/YTF driver J3.
10. Place A19 power supply/YTF driver in normal operating position. (Refer to Figure 8-13.)
11. Replace the module cover. (Refer to Figure 8-1.)



a19rem

Figure 8-14. A19 Power Supply/YTF Driver Removal/Replacement

---

## A20 Controller

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

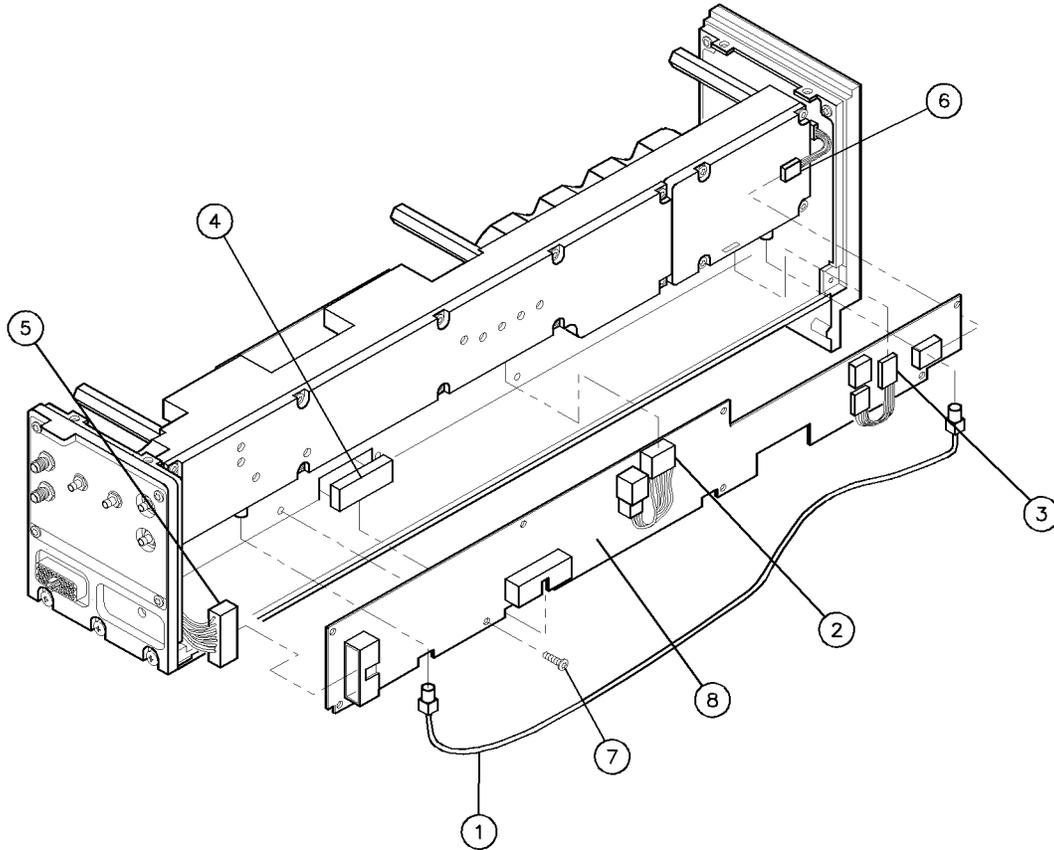
---

### To Remove the A20 Controller

1. Remove the module cover. (Refer to Figure 8-1.)
2. Remove the SMB cable W14 (1) from A10 last converter J5 and A9 2nd LO PLL assembly J1.
3. Disconnect the ribbon cable W12 (2) from A20 controller J3.
4. Disconnect the ribbon cable W37 (3) from A20 controller J4.
5. Disconnect the ribbon cable W31 (4) from A20 controller J2.
6. Disconnect the ribbon cable W35 (5) from A20 controller J1.
7. Disconnect the ribbon cable W4 (6) from A20 controller J5.
8. Remove nine screws (7).
9. Remove A20 controller (8).

### To Replace the A20 Controller

1. Replace A20 controller (8) in the module.
2. Replace nine screws (7).
3. Reconnect the ribbon cable W12 (2) to A20 controller J3.
4. Reconnect the ribbon cable W37 (3) to A20 controller J4.
5. Reconnect the ribbon cable W31 (4) to A20 controller J2.
6. Reconnect the ribbon cable W35 (5) to A20 controller J1.
7. Reconnect the ribbon cable W4 (6) to A20 controller J5.
8. Replace the SMB cable W14 (1) to A10 last converter J5 and A9 2nd LO PLL assembly J1.
9. Replace the module cover. (Refer to Figure 8-1.)



a20bdrem

**Figure 8-15. A20 Controller Removal/Replacement**

---

## A22 Status

---

**CAUTION** This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. For electrostatic discharge information, refer to “Preparing a Static-Safe Work Station” in Chapter 7.

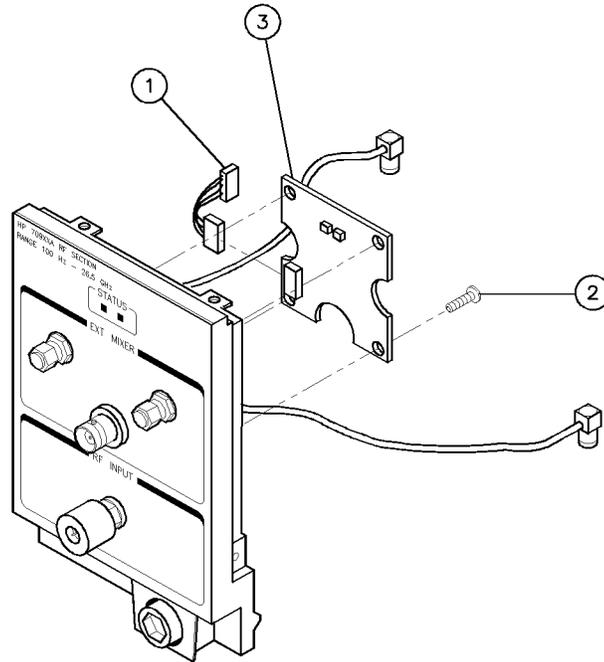
---

### To Remove the A22 Status

1. Remove the module cover. (Refer to Figure 8-1.)
2. Remove the front panel assembly. (Refer to “Front Panel”.)
3. Disconnect the ribbon cable W4 (1) from A22 status J1.
4. Remove four screws (2).
5. Remove A22 status (3).

### To Replace the A22 Status

1. Replace A22 status (3) in the front panel.
2. Replace four screws (2).
3. Reconnect the ribbon cable W4 (1) to A22 status J1.
4. Replace the front panel assembly. (Refer to “Front Panel”.)
5. Replace the module cover. (Refer to Figure 8-1.)



a22bdrem

**Figure 8-16. A22 Status Removal/Replacement**



## Overall Parts Identification Drawings

---

### Overview    In this chapter you will learn about:

- Major cable reference designators and their associated HP part numbers
  - Overall part locations through front, right, left, and rear views of your RF section
- 

This chapter contains information on all overall parts identification drawings that should be used when performing the troubleshooting procedures described in this service guide.

**Note**        Because this service guide is part of an Option OB3 package which consists of two manuals, refer to Manual 2 of 2 of this option set for information on part listings and schematics.

### Manual 2

Manual 2 is a separate volume that contains packets of component-level repair information for each RF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. Manual 2 also contains a table that can be used to cross reference different board assemblies that have different serial prefix breaks.

---

Major Cables and Assemblies .....	9-2
Front View Identification .....	9-8
Right Side View Identification .....	9-9
Left Side View Identification, Exploded .....	9-14
Rear View Identification .....	9-15

## Major Cables and Assemblies

**Table 9-1.**  
**Cables for the HP 70909A RF Section and HP 70910A RF Section**

Cable Reference Designator	HP Part Number
W1 EMIM IF IN to A6J2	8120-5531
W2 Front Panel LO to A16J1	70909-20025
W3 Tune Span OUT to A19J7	8120-5027
W4 A20 to A22 harness	8120-5541
W5 RF IN to A11 Input	70909-20017
W6 2nd LO OUT to 2nd LO In	70909-20035
W7 A6J5 to A10J1	8120-5016
W8 A6J4 to A8J2	8120-5014
W9 A16 to A6J3	8120-5532
W10 A10 321.4 MHz OUT to RP	8120-5556
W11 A18 to A16	70909-20018
W12 A10 to A20 harness	8120-5538
W13 A6J1 to A19J4	8120-5540
W14 A9 PLL to A10 3rd converter	8120-5023
W15 A14J2 to A15 coaxial switch	70910-20001
W16 A14J1 to A12 coaxial switch	70910-20002
W17 A12 coaxial switch to A21 pin switch	70910-20003
W18 A15 coaxial switch to A15 coaxial switch	70910-20004
W19 A14 YTF to A21 Pin Switch	70909-20030
W20 A14 YTF to A16 Preamp/Mixer	70909-20029
W21 Adapter, SMA(m) to (m), A15 to A16	1250-1788
W22 A11 Attenuator OUT to A21 Pin Switch	70909-20018
W23 A2 RF 1st Converter to A1 LPF	70908-20004
W24 A2 RF 1st Converter IF port to A3	70908-20042
W25 A3 to A4	70908-20043
W26 A2 RF LO IN port to A16 LO Out	70909-20026
W27 1st LO OUT to Isolator	70909-20031
W28 Adapter, SMA(m) to (m), Isolator to A16	70909-1788
W29 70909A harness, A19 to RF subassy	8120-5542
W30 70910A harness, A19 to RF subassy	5063-0603

**Table 9-1.**  
**Cables for the HP 70909A RF Section and HP 70910A RF Section**  
 (continued)

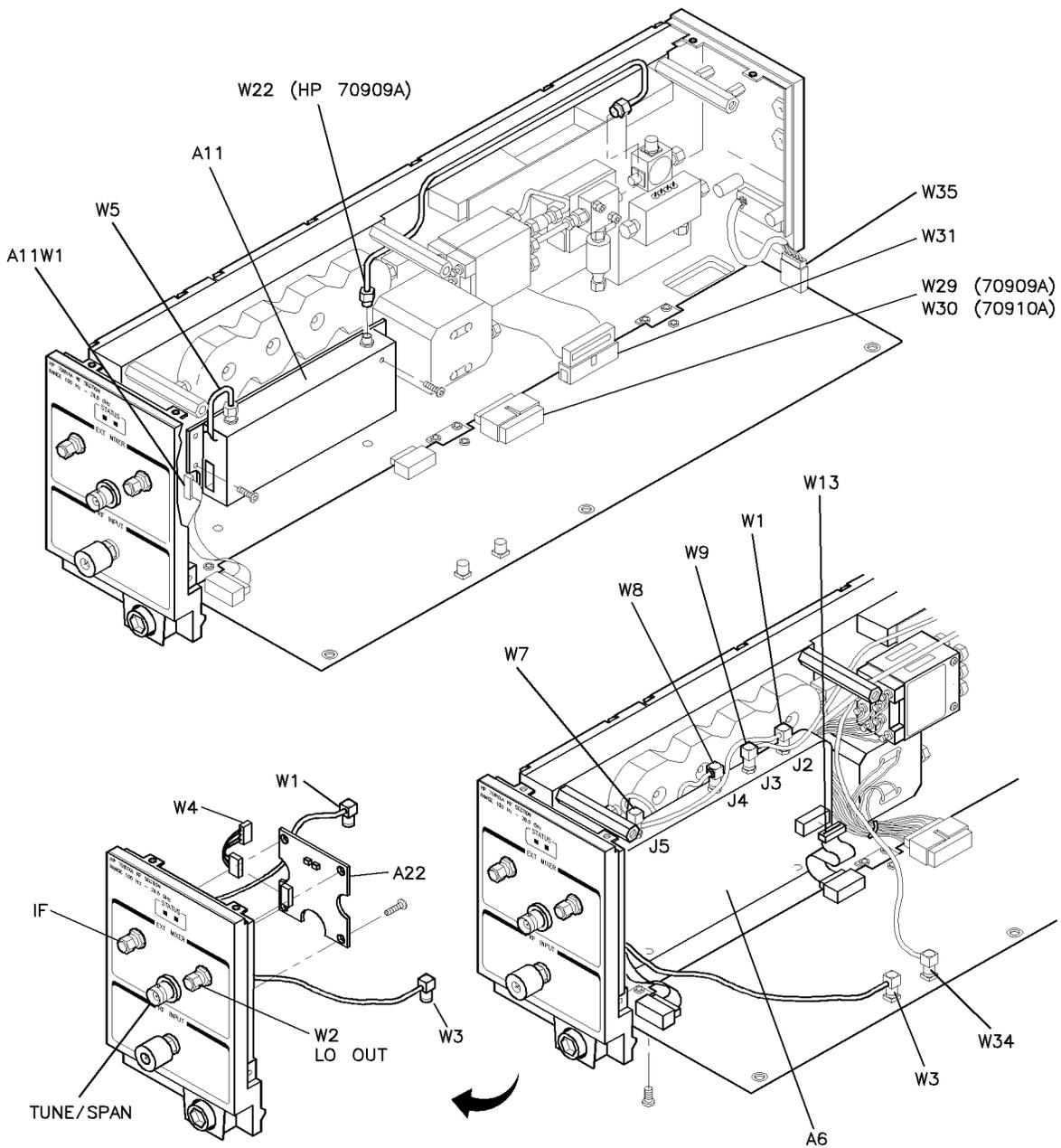
Cable Reference Designator	HP Part Number
W31 A20 to A19J2 ribbon	8120-5539
W32 1st LO IN to A18	70909-20027
W33 AUX LO OUT to A18	70909-20028
W34 Tune + Span IN to A19J5	8120-5560
W35 Hughes connector assy	70909-60020
W36 A23 Limiter to A1 LPF	70909-20020
W37 A20J4 to A9J2	8120-5536
W38 A20J5 to A22J1	8120-5541
A11W1 Attenuator to A19J10	8120-5537

**Table 9-2.**  
**Assemblies for the HP 70909A RF Section and HP 70910A RF Section**

Assembly <sup>1</sup>	Assembly
A1 2.9 GHz low pass filter	A12 RF switch/A15 RF switch (HP 70910A)
A2 RF first converter	A13 4 dB attenuator (HP 70910A)
A3 4.4 GHz low pass filter	A14 YTF
A4 18 dB isolator	A16 preamp/mixer
A5 VCO/sampler	A17 6 dB isolator
A6 programmable gain amplifier	A18 LO leveling amplifier
A7 2nd mixer	A19 power supply/YTF driver
A8 321.4 MHz matching assembly	A20 controller
A9 2nd LO PLL assembly	A21 pin switch/diplexer
A10 last converter	A22 status
A10A1 321.4 MHz band pass filter	A23 limiter
A11 5 dB step attenuator	

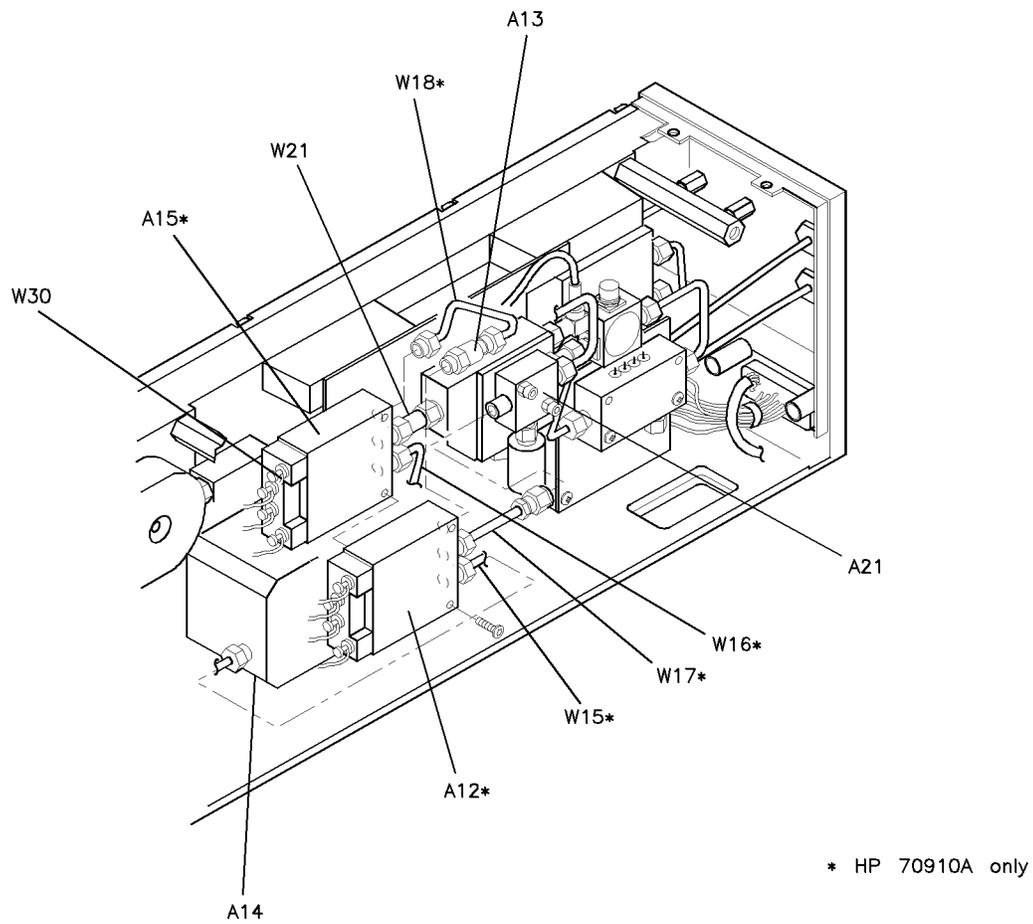
<sup>1</sup> Assemblies are listed here to help in overall parts identification. For current HP part numbers and other information relating to assemblies, refer to "Manual 2 of 2" of this option set (*HP 70909A/10A Component Level Information Package*).

Major Cables and Assemblies



parts2

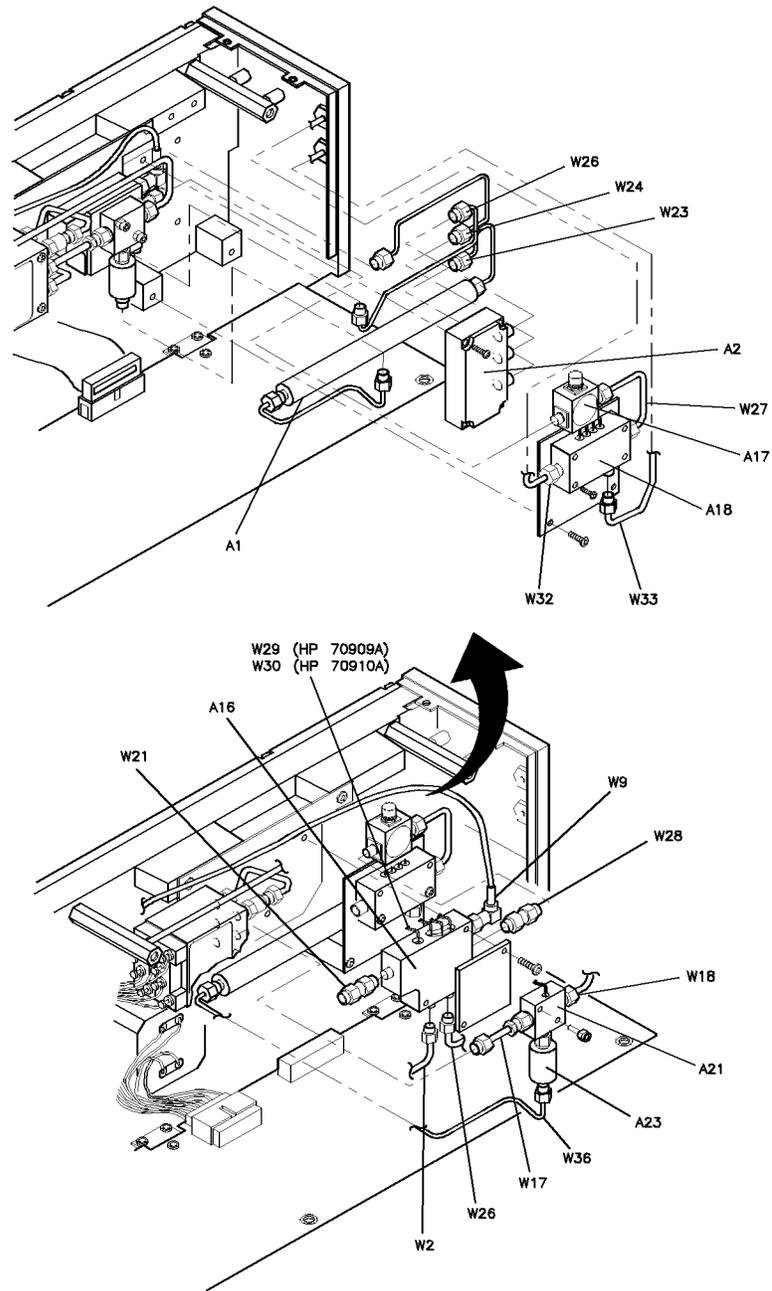
Figure 9-1. Overall Parts Identification Drawing, Major Cables (1 of 4)



parts3

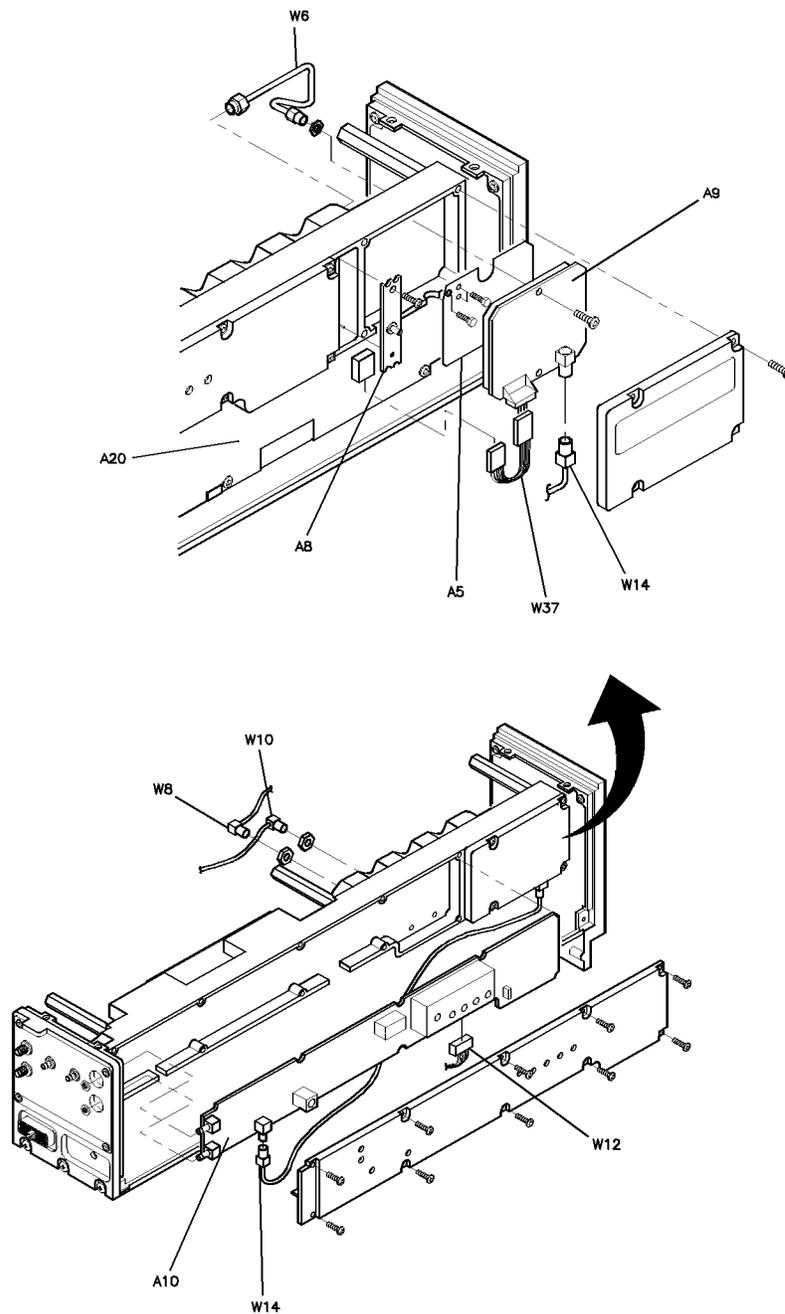
Figure 9-2. Overall Parts Identification Drawing, Major Cables (2 of 4)

Major Cables and Assemblies



parts4

Figure 9-3. Overall Parts Identification Drawing, Major Cables (3 of 4)



parts5

Figure 9-4. Overall Parts Identification Drawing, Major Cables (4 of 4)

Major Cables and Assemblies

Front View Identification

Table 9-3. Overall Parts Identification Listing, Front View

Item	HP Part Number	Description
1	1250-1957	Adapter, SMA(f) to SMA(f)
2	1810-0118	Termination, 50 ohm, SMA(f)
3	2190-0104	Washer, Lock LK .439IN-ID
4	0590-1251	Nut, Hex 15/32 - 32
5	08673-60040	Connector Assembly
6	70909-00008	Panel, Front Dress
7	2950-0001	Nut, Hex 3/8 - 32
8	2190-0016	Washer, Lock .377ID
9	2190-0761	Washer, Flat .250ID
10	2190-0067	Washer, Lock .256ID
11	2950-0216	Nut, Hex 1/4 - 36
12	70909-00001	Panel, Front

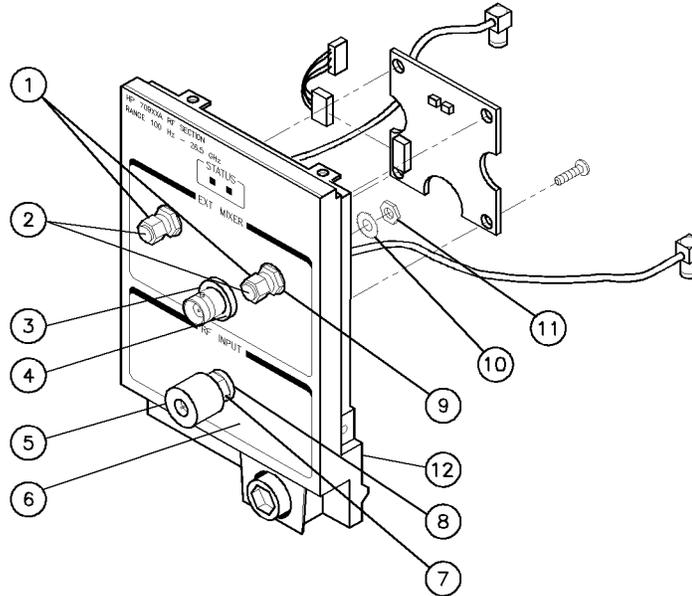


Figure 9-5. Overall Parts Identification Drawing, Front View

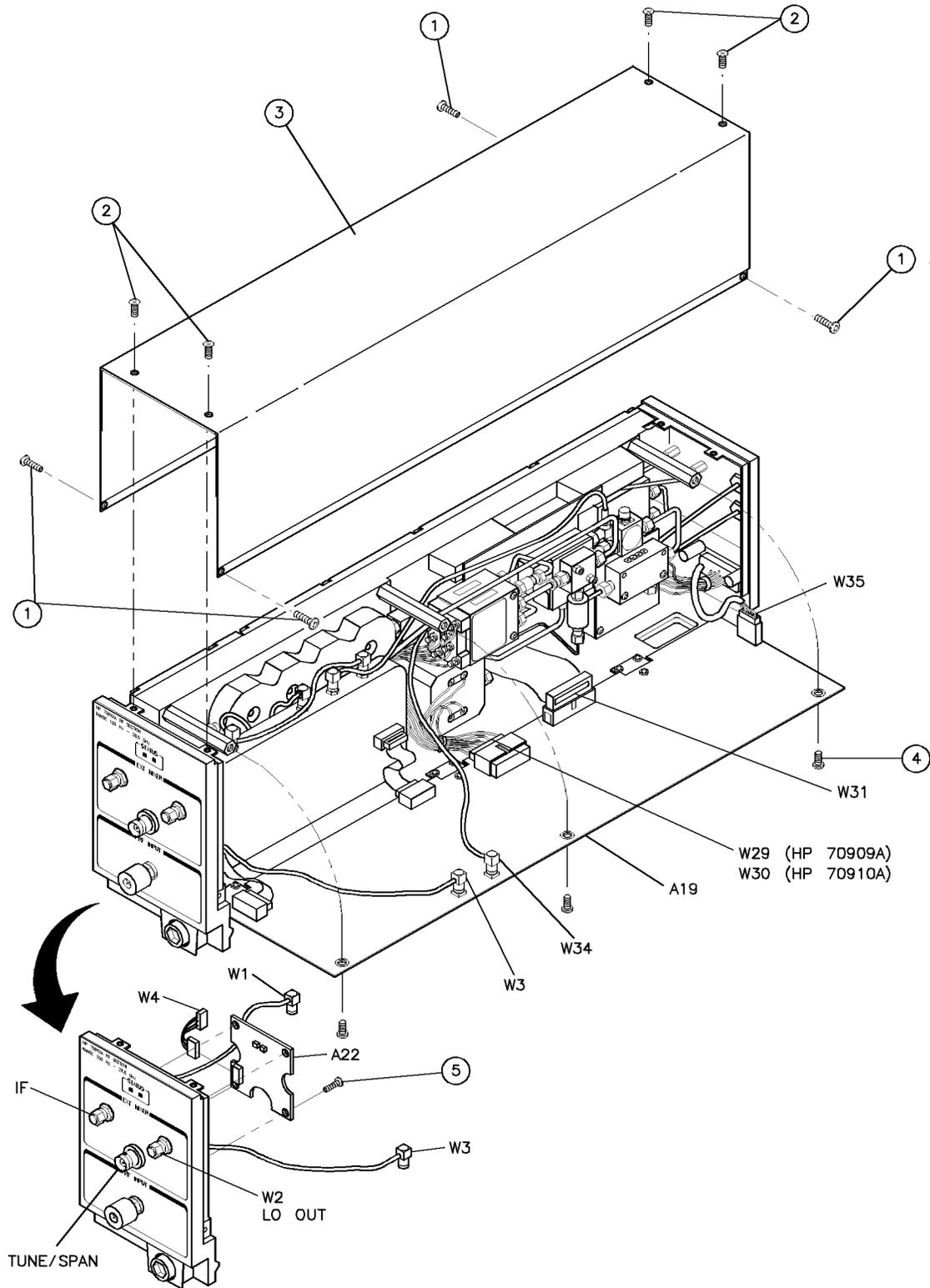
rep12

---

**Right Side View Identification****Table 9-4. Overall Parts Identification Listing, Right Side View**

<b>Item</b>	<b>HP Part Number</b>	<b>Description</b>
1	0515-2332	Screw, SMM3.0 6 PCPNTX
2	0515-1521	Screw, SMM3.0 5 FLTXX
3	70909-00002	Cover, Module
4	0515-0433	Screw, SMM4.0 8 CWPNTX
5	0515-2126	Screw, SMM3.0 6 CWPNTX
6	70908-20019	Post, PC Support
7	0515-1038	Screw, SMM3.0 35 CWPNTX
8	0515-0664	Screw, SMM3.0 12 CWPNTX
9	0515-1992	Screw, SMM2.5 20 CWPNTX
10	0515-2126	Screw, SMM3.0 6 CWPNTX
11	0515-1427	Screw, SMM2.5 20 PCPNPD
12	0515-1084	Screw, SMM3.0 12 PNTX

Right Side View Identification



repl6

Figure 9-6. Overall Parts Identification Drawing, Right Side View (1 of 4)

Right Side View Identification

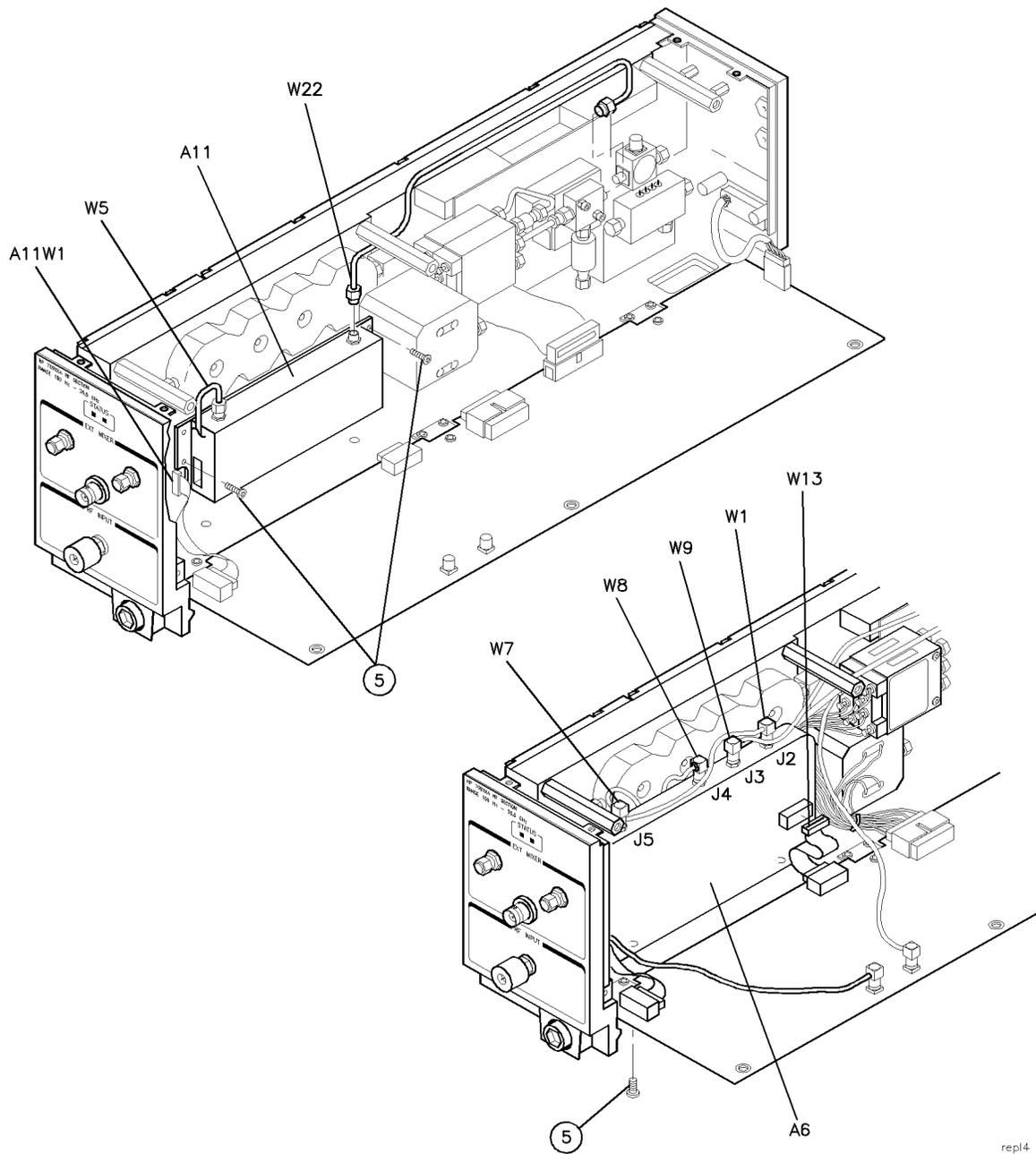
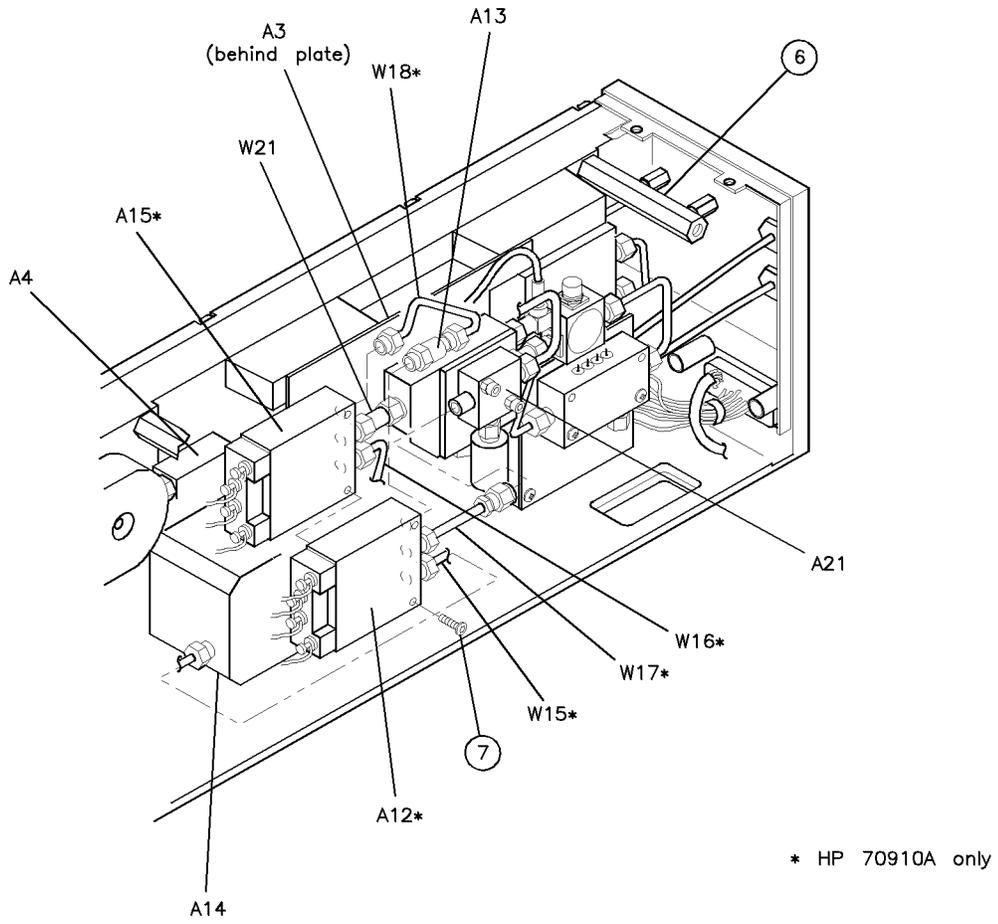


Figure 9-7. Overall Parts Identification Drawing, Right Side View (2 of 4)

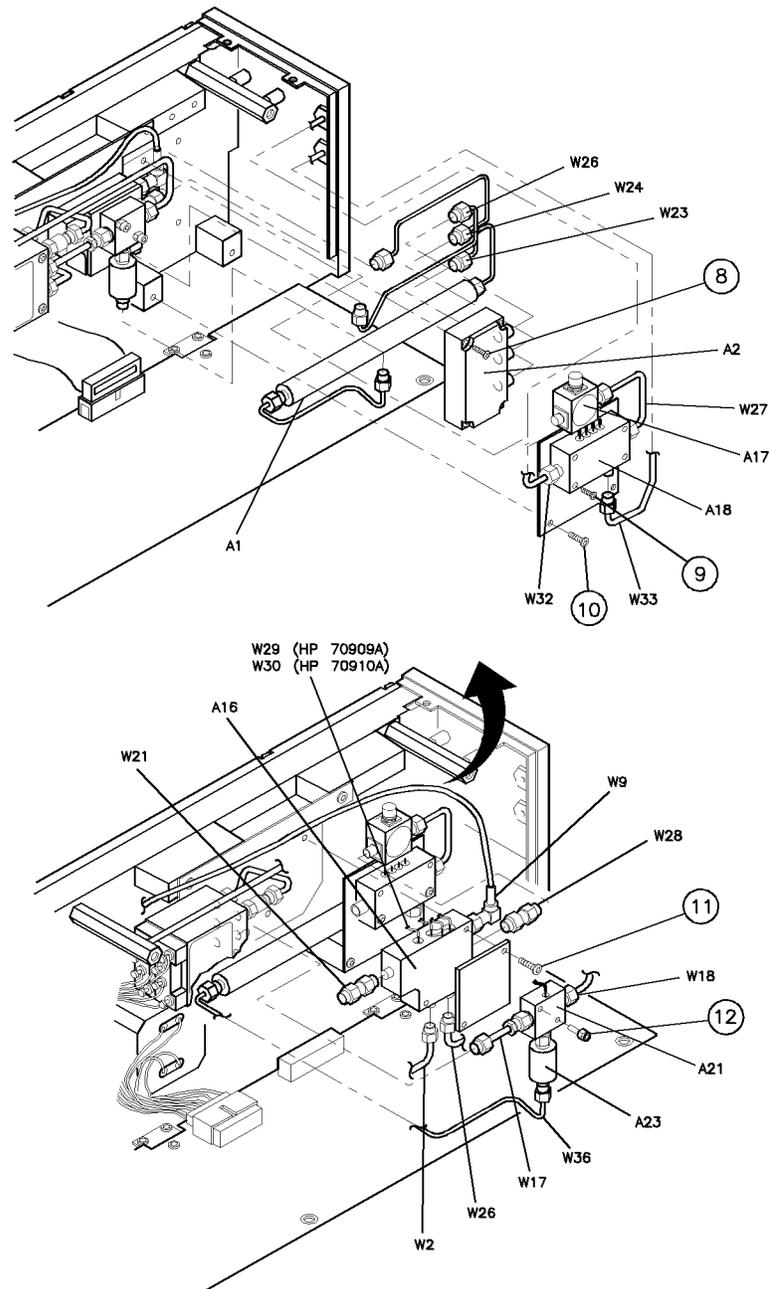
Right Side View Identification



repl3

Figure 9-8. Overall Parts Identification Drawing, Right Side View, Exploded (3 of 4)

Right Side View Identification



repl5

Figure 9-9. Overall Parts Identification Drawing, Right Side View, Exploded (4 of 4)

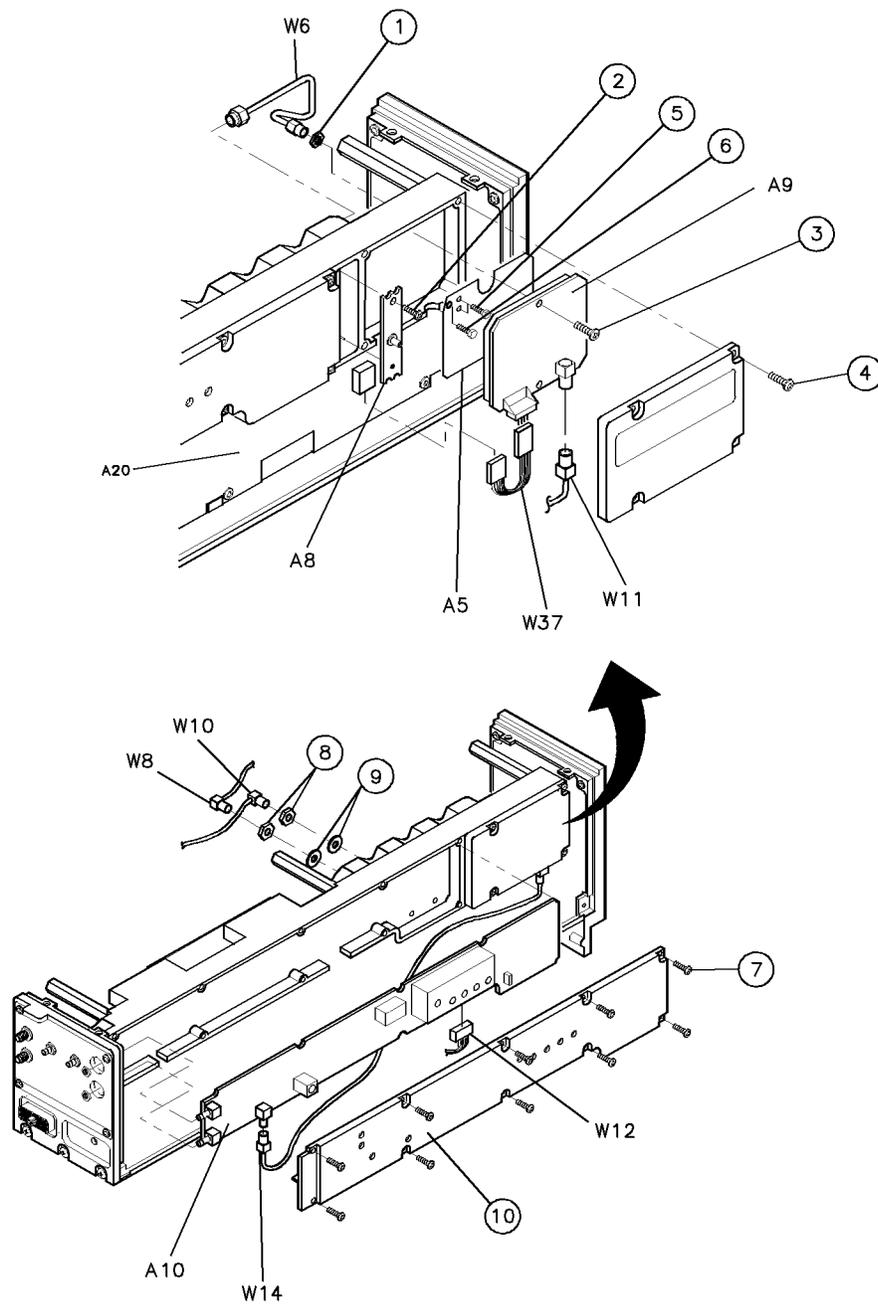
---

## Left Side View Identification, Exploded

**Table 9-5. Overall Parts Identification Listing, Left Side View Exploded**

<b>Item</b>	<b>HP Part Number</b>	<b>Description</b>
1	2950-0216	Nut, Hex 1/4-36
2	0515-2126	Screw, SMM3.0 6 CWPNTX
3	0515-0375	Screw, SMM3.0 16 CWPNTX
4	0515-0374	Screw, SMM3.0 10 CWPNTX
5	0515-0658	Screw, SMM2.0 6 CWPNTX
6	70904-20026	Screw, SCREW-OSC FEED
7	0515-2134	Screw, SMM3.0 10 CWPNTX
8	2950-0078	Nut, Hex 10-32
9	2190-0124	Washer, Lock .195ID10
10	70909-20008	Cover, Last Converter

Left Side View Identification, Exploded



rep17

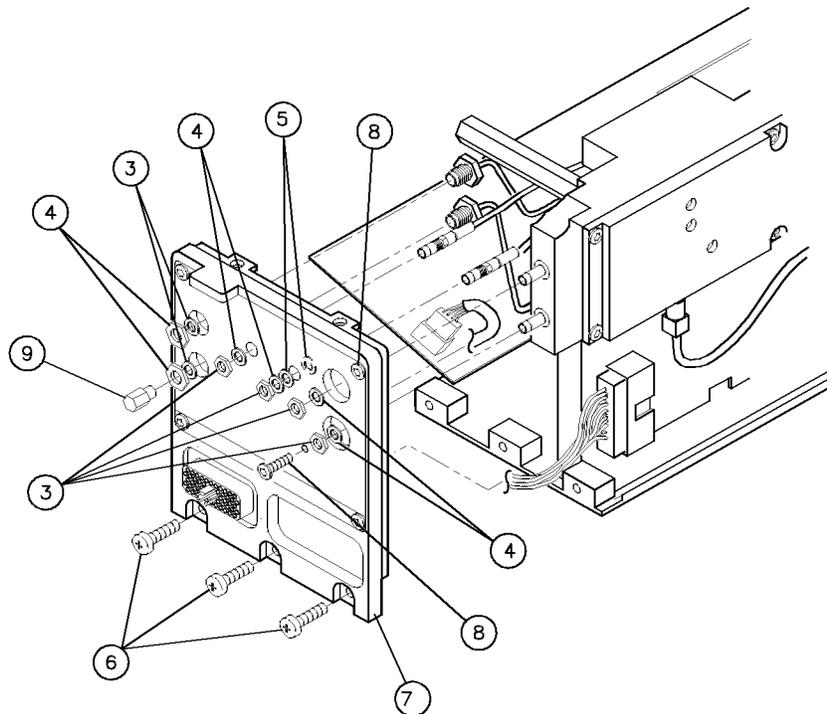
Figure 9-10. Overall Parts Identification Drawing, Left Side View, Exploded

## Left Side View Identification, Exploded

## Rear View Identification

Table 9-6. Overall Parts Identification Listing, Rear View

Item	HP Part Number	Description
1	2190-0067	Washer, Lock .256ID
2	2950-0216	Nut, Hex 1/4-36
3	2950-0078	Nut, Hex 10-32
4	2190-0124	Washer, Lock .195ID10
5	3050-1205	Washer, SH .190ID10
6	0515-2113	Screw, SMM4.0 8 PCPNTX
7	70908-20014	Frame, Rear
8	0515-2126	Screw, SMM3.0 6 CWPNTX
9	1810-0118	Termination, 50 ohm, SMA(f)



rpl1.

Figure 9-11. Overall Parts Identification Drawing, Rear View

## Index

---

### 2

2nd converter adjustments, 5-10

### 4

42.8 MHz failure, 7-28

### 6

642.8 MHz failure, 7-28

### A

A10 last converter, 7-48

removal/replacement, 8-14  
troubleshooting, 7-36

A11 5 dB step attenuator, 7-48

removal/replacement, 8-16  
troubleshooting, 7-38

A1 2.9 GHz low pass filter, 7-47

A12 RF switch/A15 RF switch

removal/replacement, 8-18  
troubleshooting, 7-39

A14 YTF

removal/replacement, 8-20  
troubleshooting, 7-40

A16 preamp/mixer, 7-48

removal/replacement, 8-22  
troubleshooting, 7-43

A17 6 dB isolator, 7-48

A18 LO leveling amplifier, 7-48

removal/replacement, 8-24  
troubleshooting, 7-44

A19 power supply/YTF driver, 7-49

removal/replacement, 8-28  
service position, 8-26  
troubleshooting, 7-40

A20 controller, 7-49

removal/replacement, 8-30  
troubleshooting, 7-45

A21 pin switch/diplexer, 7-49

troubleshooting, 7-39

A22 status, 7-49

removal/replacement, 8-32

A23 limiter, 7-49

A2 RF first converter, 7-47

removal/replacement, 8-8  
troubleshooting, 7-30

A3 4.4 GHz low pass filter, 7-47

A4 18 dB isolator, 7-48

A5, A7, A8, A9 second converter, 7-48

A5 VCO/sampler

removal/replacement, 8-10  
troubleshooting, 7-31

A6 programmable gain amplifier, 7-48

removal/replacement, 8-12  
troubleshooting, 7-34

A7 2nd mixer

troubleshooting, 7-31

A8 321.4 MHz matching assembly

removal/replacement, 8-10  
troubleshooting, 7-31

A9 2nd LO PLL assembly

removal/replacement, 8-10  
troubleshooting, 7-31

aborting a test, 3-2

aborting from menu, 3-8

aborting the test menu, 3-11

address map, default HP-MSIB, 7-11

adjustment procedure failures, 7-17

adjustments

Adjustment 01. Power Supply Voltage  
Checks, 5-5

Adjustment 02. 1st LO Power, 5-7

Adjustment 03.01 VCO Tune-Line Voltage,  
5-11

Adjustment 03.02 VCO Frequency and  
Amplitude, 5-13

Adjustment 03.03 2nd Converter LO  
Feedthrough, 5-15

Adjustment 03.04 Sampler DC IF Out, 5-17

Adjustment 03.05 Sampler AC IF Out, 5-19

Adjustment 03.06 Search Oscillator Duty  
Cycle and Period, 5-21

Adjustment 03.07 Search Oscillator Square  
Wave Min/Max, 5-23

Adjustment 03.08 Search Oscillator VCO  
Tune Line, 5-25

Adjustment 03.09 Phase Lock, 5-27

Adjustment 03.10 VCO Tune Range, 5-29

Adjustment 03.11 Lock Range  
Measurement, 5-32

Adjustment 03.12 Bandpass Filter and VCO  
Tune Range Final, 5-34

Adjustment 03.13 Mixer Bias, 5-37

Adjustment 04. Last Converter Alignment, 5-39  
 Adjustment 05. PGA Calibration, 5-44  
 Adjustment 06. YTF Alignment, 5-46  
 Assemblies, CLIP Packets, Manual 2, 1-4, 8-1, 9-1

**B**

battery-low indicator  
 memory card, 7-7  
 blank display, 7-5  
 block diagram, 7-53

**C**

CAL FACTOR data file  
 creating new, 3-18  
 naming conventions, for noise sources, 3-12  
 naming conventions, for power sensors, 3-19  
 printing, 3-29  
 purging, 3-30  
 storing, 3-31  
 CLIP Packets, Manual 2, 1-4, 8-1, 9-1  
 computer keyboard, compatibility, 2-3  
 computer requirements, 2-3  
 confidence test, 7-8  
 configuring, HP-IB cables, 2-15  
 configuring software, 2-11  
 contacting Hewlett-Packard, 1-6

**D**

default  
 equipment list, 3-8  
 HP-MSIB address map, 7-11  
 TSCRIPT models, 2-19  
 definition  
 default HP-MSIB address map, 7-11  
 module verification tests, 1-3  
 system performance tests, 1-3  
 system verification tests, 1-3  
 display  
 blank the, 7-5  
 distorted, 7-5  
 tests, 7-7  
 distorted display, 7-5  
 DUT, definition, 3-2

**E**

EDIT\_MSTAB, running, 2-23  
 entering  
 calibration data, 3-18  
 equipment list, printing, 3-8  
 error  
 "6000 EAROM Unprotected", 7-45

errors, system, 7-16  
 ESD (electrostatic discharge), 7-2, 7-3

**F**

failures

2nd Converter, 7-18  
 Adjustment 01. Power Supply Voltage Checks, 7-17  
 Adjustment 02. 1st LO Power, 7-17  
 Adjustment 03.02 VCO Frequency and Amplitude, LO Amplitude, 7-19  
 Adjustment 03.02 VCO Frequency and Amplitude, LO Frequency, 7-19  
 Adjustment 03.03 2nd Converter LO Feedthrough, 7-19  
 Adjustment 03.04 Sampler DC IF Out, 7-19  
 Adjustment 03.05 Sampler AC IF Out, 7-19  
 Adjustment 03.06 Search Oscillator Duty Cycle and Period, 7-20  
 Adjustment 03.07 Search Oscillator Square Wave Min/Max, 7-20  
 Adjustment 03.08 Search Oscillator VCO Tune Line, 7-20  
 Adjustment 03.09 Phase Lock, 7-20  
 Adjustment 03.10 VCO Tune Range, 7-21  
 Adjustment 03.11 Lock Range Measurement, 7-21  
 Adjustment 03.12 Bandpass Filter and VCO Tune Range Final, 7-21  
 Adjustment 03.13 Mixer Bias, 7-21  
 Adjustment 04. Last Converter Alignment, 7-21  
 Adjustment 05. PGA Calibration, 7-22  
 Adjustment 06. YTF Alignment, 7-22  
 Test 01. Switch Repeatability, 7-23  
 Test 02. External Mixer Gain Calibration, 7-23  
 Test 03. Gain and Flatness Calibration, 7-23  
 Test 04. Flatness Below 50 MHz, 7-24  
 Test 05. Microwave Gain and Noise Figure, 7-24  
 Test 06. External Mixer Noise Figure, 7-25  
 Test 07. Microwave TOI, 7-25  
 Test 08. Diagnostics Check, 7-25  
 Test 09. Front Panel LEDs Check, 7-26  
 Test 10. 21.4 MHz IF Output Response, 7-26  
 Test 11. IF Emissions and Harmonics, 7-26  
 Test 12. EMIM LO Out Power and Harmonics, 7-27  
 Test 13. 1st LO Out Power and Harmonics, 7-27  
 Test 14. TUNE+SPAN+PRESEL PEAK Output, 7-27

- Test 15. LO Input Amplitude Range, 7-28
- Test 16. Microwave Image Rejection, 7-28
- Test 17. EMIM Image Rejection, 7-28
- Test 18. 2nd Converter Startup, 7-28
- Test 19. Microwave Residual Responses, 7-29
- Test 20. Microwave In-Range Multiples, 7-29
- fault indicator, 7-6
- front panel
  - removal/replacement, 8-4
- full microwave source, specifying address, 2-21

**G**

- gain and flatness problems, 7-23

**H**

- hardware
  - errors, 7-14
  - required, 2-3
- high power, 7-23
- how to
  - check operation of cables, 7-10
  - check operation of mainframes, 7-10
- HP BASIC version supported, 2-2
- HP-IB cables, configuring, 2-15
- HP-IB printer address, 2-15, 2-20, 3-6, 3-8, 3-29
- HP-MSIB
  - indicator light, 7-6
  - troubleshooting, 7-6
- humidity setting, change, 3-5

**I**

- indicator
  - HP-MSIB light, 7-6
- indicator, RAM memory card battery-low, 7-7
- information not covered, 1-5
- input power, maximum, 7-30
- installation, software, 2-5

**L**

- low power, 7-23

**M**

- major cables, 9-2
- Manual 1, Service Guide, 1-3
- Manual 2, CLIP Packets, 1-4, 8-1, 9-1
- maximum input power, 7-30
- module
  - cover removal/replacement, 8-2
  - serial numbers, 1-6
  - verification tests, 1-3

- mouse operation, 2-4
- MS\_TABLE
  - automatically updated, 3-15, 3-31
- MS\_TABLE, running, 2-23

**N**

- network analyzer, specifying address, 2-21

**O**

- operating errors, 7-13
- Option 915, now referred to as Option OB3, 1-3, 8-1, 9-1

**P**

- Part Listings, CLIP Packets, Manual 2, 1-4, 8-1, 9-1
- PC board connector cleaning, 7-2
- performance, system performance tests, 1-3
- power holes, 7-23
- power sensor
  - models not supported, 3-18
  - serial numbers, 3-19
- printing
  - calibration file, 3-29
  - equipment list, 3-8
- purging a calibration file, 3-30
- purging software, 2-10

**R**

- RAM memory card
  - battery-low indicator, 7-7
- rear panel
  - removal/replacement, 8-6
- related adjustments, 7-47
- removal/replacement
  - A10 last converter, 8-14
  - A11 5 dB step attenuator, 8-16
  - A12 RF switch/A15 RF switch, 8-18
  - A14 YTF, 8-20
  - A16 preamp/mixer, 8-22
  - A18 LO leveling amplifier, 8-24
  - A19 power supply/YTF driver, 8-28
  - A20 controller, 8-30
  - A22 status, 8-32
  - A2 RF first converter, 8-8
  - A5, A7, A8, A9 second converter, 8-10
  - A6 programmable gain amplifier, 8-12
  - front panel, 8-4
  - module cover, 8-2
  - rear panel, 8-6
- Replacement Parts, CLIP Packets, Manual 2, 1-4, 8-1, 9-1

**S**

- save TSCRIPT, 2-22
- scalar network analyzer, specifying address, 2-21
- serial number
  - determining, 1-6
- serial numbers
  - power sensor, 3-19
- serial numbers, module, 1-6
- Series 300 computer, 2-3
- service
  - before beginning, 1-5
  - contacting Hewlett-Packard, 1-6
  - overview, 1-2
  - returning to Hewlett-Packard, 1-8
- service position
  - A19 power supply/YTF driver, 8-26
- software
  - available, 1-3
  - computer software required, 2-2
  - configuring, 2-11
  - entering DUT information, 3-3
  - installation, 2-5
  - loading, 3-2
  - purging, 2-10
  - TSCRIPT file, 2-16
- static-safe work station, 7-2
- static-shielding containers, 7-3
- stopping a test, 3-2
- storing
  - calibration file, 3-31
- system
  - errors, 7-16
  - performance tests, 1-3
  - verification tests, 1-3

**T**

- temperature setting, change, 3-5
- test menu, aborting, 3-11
- tests
  - confidence, 7-8
  - display, 7-7
  - module verification tests, 1-3

- system performance tests, 1-3
- system verification, 1-3
- troubleshooting
  - A10 last converter, 7-36
  - A11 5 dB step attenuator, 7-38
  - A12 RF switch/A15 RF switch, 7-39
  - A14 YTF, 7-40
  - A16 preamp/mixer, 7-43
  - A18 LO leveling amplifier, 7-44
  - A19 power supply/YTF driver, 7-40
  - A20 controller, 7-45
  - A21 pin switch/diplexer, 7-39
  - A2 RF first converter, 7-30
  - A5 VCO/sampler, 7-31
  - A6 programmable gain amplifier, 7-34
  - A7 2nd mixer, 7-31
  - A8 321.4 MHz matching assembly, 7-31
  - A9 2nd LO PLL assembly, 7-31
  - communication on the HP-MSIB I/O, 7-10
  - duplicate HP-MSIB addresses, 7-11
  - error messages, 7-13
- TSCRIPT
  - creating backup, 2-17
  - editing address lists, 2-18
  - loading, 2-17
  - saving edits, 2-22
  - specify ADDRESS TYPE, 2-21
  - specify full microwave source address, 2-21
- TSCRIPT.MS, backup filename, 2-18
- TSCRIPT, save, 2-22

**U**

- UUT, definition, 3-2

**V**

- verification tests
  - failures, 7-23
  - system, 1-3

**W**

- working copies
  - creating, 2-6
  - purging, 2-10